FLIGHT

The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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CONTENTS

DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:—

1926

July 19–Aug. 7	**French Competition for Multi-engined Seaplanes, St. Raphael-Frejus.**
July 31	**Entries close (at special fee) for Light 'Plane Competition, Lympne.**
Aug. 9-15	**French Light 'Plane Competition.**
Sept. 10-17	**Two-Seater Light Aeroplane Competition, Lympne.**
Sept. 18	**Grosvenor Challenge Cup, at Lympne.**
Oct.	**Schneider Cup Race at Norfolk, Virginia, U.S.A.**
Oct. 24-28	**Coppa del Mare, Italy.**
Nov. 11-15	**Coppa d'Italia, Italy.**
Nov.–Dec.	**Paris Aero Show.**

EDITORIAL COMMENT.

DISAPPOINTING is a term somewhat apt to come to mind in looking through the list, published elsewhere in this issue of FLIGHT, of the entries for the two-seater light 'plane competition for the *Daily Mail* Prizes, totalling £5,000, which is to be held under the competition rules of the Royal Aero Club at Lympne in September next. The number of entries, 16, is not in itself all that it might have been, but it is not in the actual number of entries that the disappointment lies so much as in the fact that but very few new machines appear to have been entered. It is somewhat of a reflection on the aircraft industry that out of the new types entered the majority has been entered not by "the trade" but by private individuals and clubs. That independent efforts by "outsiders" should be so much in evidence is, of course, a matter for congratulation, and everyone will wish these venturesome sportsmen all good fortune in the competition. Theirs is the right spirit. But that the aircraft industry has not responded more generally and generously can only be regarded as disappointing.

Lympne

We realise, of course, that the design and construction of even a small two-seater light 'plane is no cheap proposition, but the prizes offered are on such a generous scale in proportion to the cost of the machines that it might have been expected that many more firms would have come forward, merely regarding the competition as a venture financially, and quite a reasonable venture at that. Then there is the effect of winning such a competition, which is not readily assessed but which must be very considerable. It may possibly be that many firms do not see any use for the type of machine which the competition is likely to produce, and so have refrained on that score from entering. But for the sake of British sporting flying the scant response of the industry is to be regretted.

On the other hand, possibly quite a number of firms may have decided that even by designing entirely new types they were not likely to do much better, under the rules of the competition, than with their existing

models, and so have confined themselves to minor detail modifications and improvements, and as the engines used will play an important *role* in the competition, there has been a certain re-shuffling of engines, while at least one new type has been produced specially for the competition, or at any rate just in time to take part in considerable numbers. This is the new Armstrong-Siddeley "Genet," about which little has been allowed to become known at the moment. It is rumoured to be a radial air-cooled, and is just about to complete its Air Ministry type tests, if indeed it has not already completed these by the time this issue of FLIGHT is in the hands of our readers. As usual, quite a large number of Bristol "Cherubs" are being fitted, and it seems likely that the entire stock of "Cherubs" has now been exhausted, as we gather that the Bristol company does not propose to build any more of this particular type. The only two other types to be represented are the A.B.C. "Scorpion," which at the moment has not, we believe, passed its type tests although it is expected to do so shortly, and the Blackburne "Thrush," which passed the tests several months ago with, so far as we have been able to ascertain, no difficulty whatever.

Concerning the competition itself, the regulations for this were published in FLIGHT of April 29, 1926, and there is little need to refer to them here beyond mentioning that, after having passed the eliminating trials, the competition will consist in carrying, over a "star-shaped" course of something like 2,000 miles, the greatest useful load for the smallest fuel consumption.

• • •

Warnemunde At the time of going to press, the final results of the German seaplane competition at Warnemünde are not available, and it may be some little time before they are definitely settled. This is due to the fact that the final test in the competition consists in a seaworthiness trial, in which the machines are required to taxy, take off, alight, and describe figures-of-eight in a seaway of magnitude 4. It seems obvious that this will necessarily mean waiting until such a seaway is encountered, as anything less would let the machines off too easily, while anything more might prove too difficult, and so the final results, which will be determined by whether or not machines pass this test, cannot be expected for some time.

The detail result of the coastal flights, in which the reliability was being tested, are not available, and these again will greatly affect the final classification, but the "figures of merit" awarded in the performance tests are to hand, and will be found on page 465.

It will be seen that out of the 18 machines entered (a late entry was the Udet U.13) 10 succeeded in passing the performance tests. Two machines were scratched, one was not completed in time, and the others fell out for various reasons. Among these were the two Rohrbach flying-boats, which did not complete their performance tests in time. The same applies to the Udet U.13.

In the performance tests it is gratifying to find that machines fitted with British engines did very well. Thus the highest "figure of merit" was gained by the Junkers monoplane, type W.34, which is fitted with a Bristol "Jupiter" engine. Next came the Heinkel H.E.5 monoplane with Gnome & Rhone "Jupiter." Fifth in this section of the competition was the Heinkel H.E.5 with Napier "Lion," and sixth the L.F.G. V.61 with Bristol "Jupiter." By the time the marks gained in the reliability flights along the Baltic coast are added, it seems likely that these results may be considerably affected, but the British-engined machines, as far as can be seen at present, promise to be well to the fore.

HONOURING SIR FRANCIS K. McCLEAN, A.F.C.

Banquet at Savoy Hotel

SOME hundred and thirty members of the Royal Aero Club and their friends gathered together at the Savoy Hotel on July 27 to mark their appreciation of the honour—somewhat overdue in the estimation of many—of knighthood recently conferred upon Lieut.-Col. Francis K. McClean. It was a memorable occasion, and the only regret was the inability of a number of old friends to attend personally to join in the congratulations which were so enthusiastically offered to Sir Francis.

His Grace the Duke of Sutherland presided, and the after-dinner proceedings opened with the formal presentation of the King's Cup to Sir Charles C. Wakefield, Bart., the entrant of the winning machine, followed by the additional prizes to the various winning entrants and the pilots of the machines. The extra prize of £100, which was attached to the winning machine, was promptly, as received, passed on amid cheering by Sir Charles Wakefield to the pilot, Capt. H. S. Broad—Sir Charles emphasising the point that the encouragement given to aviation by His Majesty was an inspiration to all interested in the science. In these races, he continued, the human element counted for much, and it was not only the wonderful machine which had to have the credit of winning, but the remarkable skill of the pilot which counted for so much. Incidentally, he congratulated the handicappers for their accuracy, as judged by results, in dealing with the varied entries.

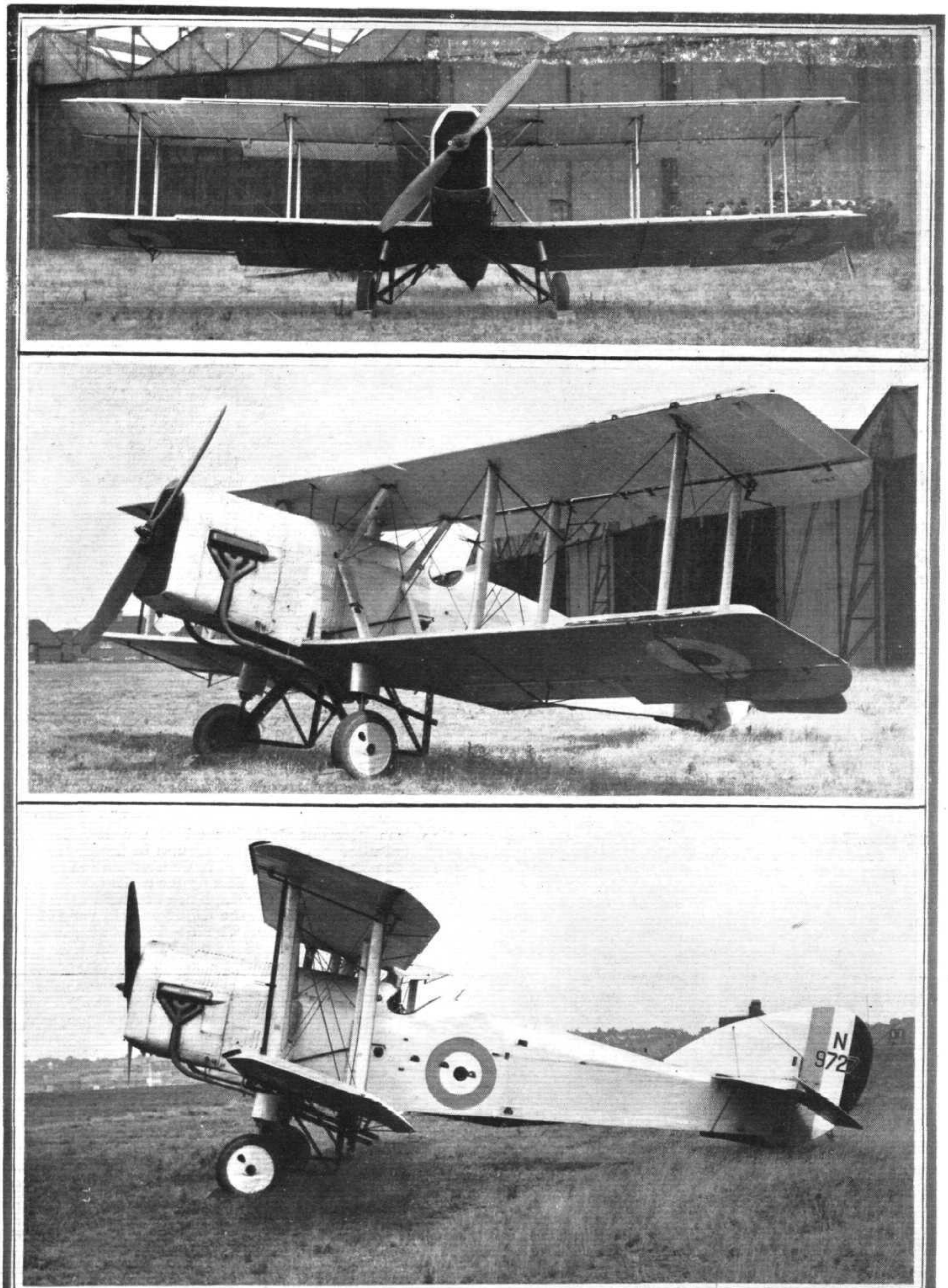
The chairman, in proposing the toast of "Sir Francis," said "we might call him the father of naval flying," and then detailed a long list of the splendid, untiring, unselfish and persistent work done by Sir Francis since before 1908 for aviation in all its aspects. He had proved himself a practical pioneer in the art of science which would go to the making of aeronautical history.

Lieut.-Col. Moore-Brabazon, M.P., in supporting the toast, suggested that the present banquet might well have been held fifteen years ago, so splendid were the early efforts made by Sir Francis on behalf of aviation.

Air Commodore Longmore, one of the first four naval pilots who in the early Eastchurch days received their initiation into piloting through the generous assistance of the Admiralty, in supporting the toast, spoke feelingly of the helpful and valuable work done by Sir Francis, especially in those dark days of aviation when flying was anathema to the naval authorities, almost to the limit of ridicule.

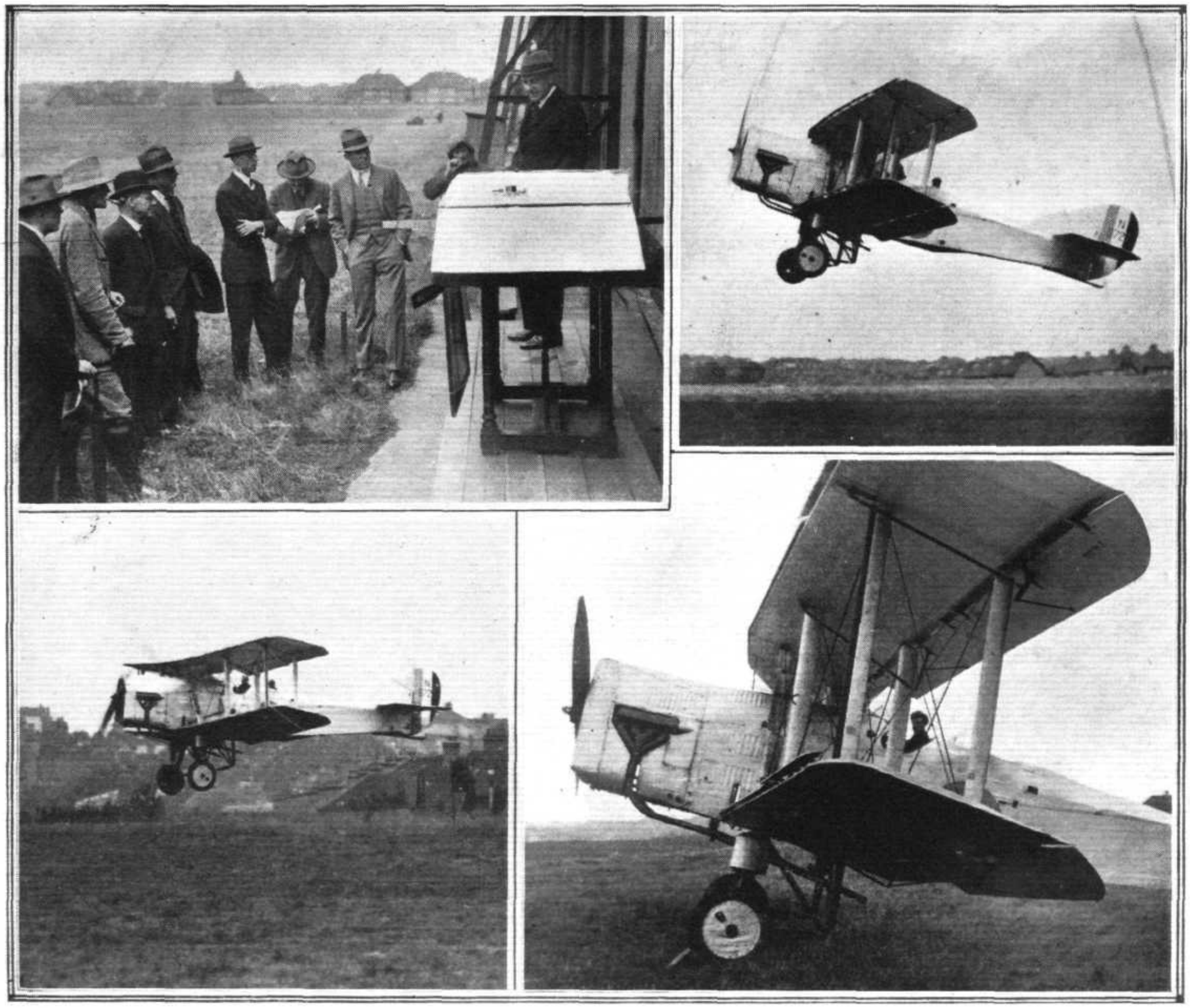
Sir Francis McClean, in replying, was glad to see how the light aeroplane clubs were bringing the amateur flyers to life again, and he hoped and thought that by next year there would be sufficient of these pilots to demand a class of their own in air races. In concluding his thanks for his reception, he pointed out that flying race meetings were held at a loss, and he therefore strongly appealed to the public to support them and to give assistance to the Royal Aero Club in carrying on the work it had been doing for the last twenty years, so as to enable them to carry on and so keep up England's name in the world of aviation.

With the toast of "The Chairman," proposed by Air Vice-Marshal Sir W. Sefton Brancker, a very memorable function was brought to a close.



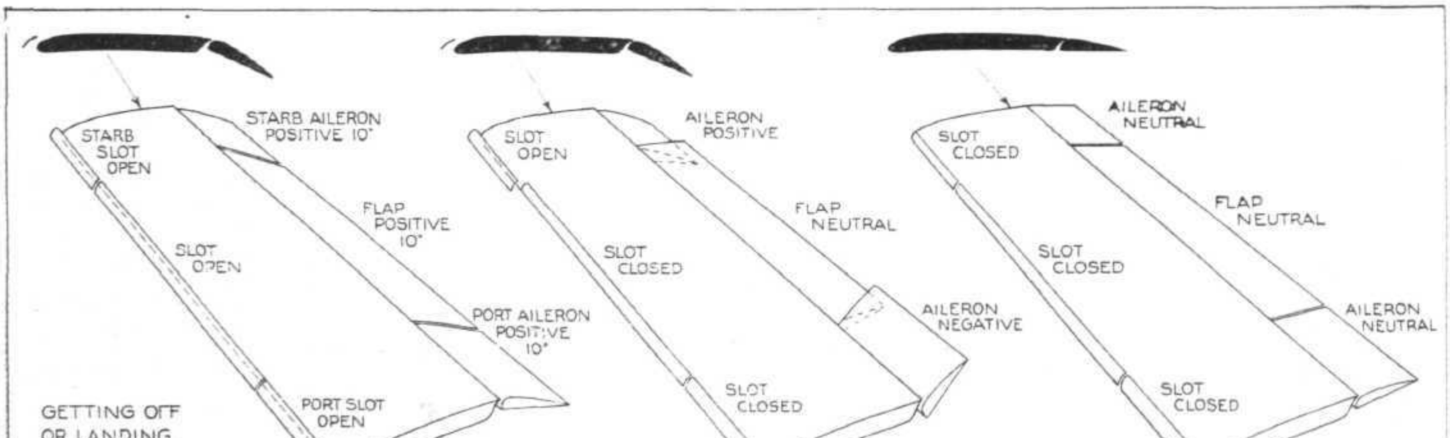
["FLIGHT" Photographs

THE HANDLEY PAGE "HENDON": This is a torpedo plane with slotted wings. The engine is a Napier "Lion." The auxiliary aerofoils on the leading edge are of the more recent type, made from Duralumin sheet, which lie snugly against the leading edge when the slot is closed. (See pages 460 and 461).



[" FLIGHT " *Photographs*

SLOT CONTROL : On Tuesday of last week a demonstration was given at Cricklewood of the new Handley Page " Hendon," which is fitted with leading edge slots and slotted ailerons. The photograph in the upper left-hand corner shows Mr. F. Handley Page explaining the action of the slots by means of a demonstration model. Major Davidson, U.S. Attaché, nearest Mr. Handley Page, appears very interested. The upper right-hand photograph shows the " Hendon " taking off, piloted by Capt. Wilcockson. Note that the flaps are down and the slots open. On the left the machine is seen landing, and it will be noticed that, although the flight path is very steep, the machine is not tail-down. On the right a close-up view of the front of the machine. The lift-slot is only partially open, while the port control slot is fully open and the port aileron down. (See pp. 459 and 461.)



SLOT CONTROL : Diagrammatic representation of the system used on the Handley Page " Hendon." There is a main slot and a main trailing edge flap, which are used to give extra lift, while the wing-tip slots and flaps are used chiefly for control. On the left is shown the position occupied by the flaps and slots for slow flying. The control slots and their flaps are still available for lateral control. The position shown in the centre corresponds to fast flying with lift slot closed and main flap neutral, while the starboard control slot is open and its flap down, to produce anti-clockwise roll. On the right, the position in normal straight flight with slots closed. (See pp. 459 and 461.)

THE HANDLEY PAGE "HENDON"

New Slot-Control Machine Demonstrated

SINCE Mr. Handley Page in this country and Dr. Ing. Lachmann in Germany first invented the slotted aerofoil more or less simultaneously, the progress made with this device has appeared somewhat slow, certainly more so than many enthusiasts had expected, and it is a somewhat curious fact that hitherto not a single commercial aeroplane in use in this country has been fitted with slotted wings. In Germany, on the other hand, at least three machines have been built incorporating this feature. The Udet firm of Munich produced a slotted-wing monoplane last year. The Albatros Works, of Berlin-Johannisthal, turned out a newspaper carrier, a biplane with slotted wings, early this year designed by Dr. Lachmann, and finally another Udet machine was entered at the eleventh hour for the German seaplane competition that is just coming to a close at Warnemünde. In this country, on the other hand, the slotted wing has so far been used on service type of aircraft only, of which the Handley Page Company has built several. One of the latest to be produced at Cricklewood is the "Hendon," a torpedo carrier fitted with Napier "Lion" engine. Hitherto regarded as one of our "secret" machines the "Hendon" has now been "released," and on Tuesday of last week, July 20, a demonstration took place at Cricklewood, at which a number of representatives of the press, as well as certain foreign Air Attachés, and others interested, were present.

The "Hendon" was piloted by Handley Page's chief test pilot, Capt. Wilcockson, who took up a number of passengers from among the visitors present. The machine certainly flew remarkably slowly when the wing slots were open, and the pilot put it through a number of evolutions to show the effectiveness of the lateral control. His flat turns were particularly impressive. It was noticed that in taking off with slots open and flaps down, the "Hendon" climbed at a very steep *angle*, but apparently the rate of climb was not out of the ordinary, and in point of fact, we are informed that the rate of climb is better with slots closed, although the angle of climb is then not so good.

When flying slowly the machine was approximately on an even keel, which was also its attitude when descending along a flight path steeply inclined to the horizontal. This is, of course, explained by the fitting of trailing edge flaps interconnected with the slots, since the effect of the flaps is virtually to increase not only the camber, but angle which the wing chord forms with the centre line of the machine. In descending at an angle which would certainly correspond to a stalled condition on a normal machine, the "Hendon" appeared to be under perfect lateral control, and whatever may be the merits of the slotted wing for giving increased lift (and this is a subject upon which opinions seem to differ very considerably), there cannot, we think, be any question that the slot-cum-flap lateral control does very definitely provide that extra safety in the stalled condition which results from ample lateral control.

The diagram printed on p. 460 shows how the slots and flaps on the "Hendon" are arranged. The auxiliary aerofoil, which is of the single surface (*i.e.*, flat sheet) type, is divided into a long centre portion and two shorter end portions. The centre portion may be described as providing a "lift slot," while the end portions are "control slots." By this is meant that the central slot and the central trailing edge flap, used in conjunction, give extra lift, while the end slots, the auxiliary aerofoils of which are inter-connected with short trailing edge flaps, are, of course, used to obtain powerful lateral control.

In flight with lift slot partly open, the two aerofoils of the control slots are slightly less open than the main slot, and with the lateral control "full on," one control slot closes altogether, while the other opens fully, *i.e.*, its aerofoil moves out level with the lift slot aerofoil. In taking off and landing when maximum lift is required, all slots are open and all flaps down, although the control flaps still retain a further movement for lateral control, and in this condition lateral control is obtained mainly by raising the flap and closing the slot on the rising side, thus *decreasing* the lift on that side.

We understand that in a more recent arrangement an even more effective control action is obtained, but even with the present arrangement there can be no doubt that very powerful lateral control is obtained, and we understand that it is claimed that this is not accompanied by the usual necessity for a very powerful rudder, as the forces on the two sides are approximately balanced as regards yawing moments.

For illustrations see pages 459 and 460.

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AIR MAILS

THE Postmaster-General announces that a new edition of the Air Mail Leaflet, embodying particulars of certain changes in the Air Mails, has been issued. A copy may be obtained free on application at any Head or Branch Office, or from the Secretary (Air Mails), General Post Office, London, E.C.1.

A summary of the chief Air Mail changes is given below. For further particulars reference should be made to the Leaflet. The Air Route numbers quoted refer to the new Leaflet.

Letter Air Mails.—(i) A new Route 2, from London to Lyons, Geneva and Marseilles, offering advantage each weekday for letters to the destinations mentioned, and, on Fridays, an opportunity of overtaking the weekly Indian Mail. In combination with the existing Route 1 (London to Bâle), an advantage is offered on most days of the week for letters to Egypt, and to neighbouring countries. (ii) A new Route 4, by ordinary afternoon service from London to Paris, connecting in Paris with the air service next morning for Nuremberg, Prague, Vienna, Budapest, Belgrade, Bucarest and Constantinople. (iii) New direct Air Mails by Route 5 to Frankfort-on-Main and Munich. (iv) By Route 7, an increased advantage for letters to Finland through the use of the Stockholm-Helsingfors air service. (v) By Route 9, from London to Moscow, advantage is given for letters to the Far East. (vi) Advantage is now offered for letters to some of the Provinces of Canada, and an increased advantage for letters to many parts of the United States. (vii) The rate of air fee payable on Air Mail letters for Denmark, Sweden and Norway has been reduced from 4*d.* to 3*d.* per oz.

Parcel Air Mails.—The following changes have been introduced :—(i) Reductions in the rates of postage on air parcels for Holland, and for Germany if sent by air as far as Cologne only, for distribution thence by train. (ii) New direct parcel Air Mails to Hamburg and Berlin. (iii) An official air parcel service to Switzerland. (iv) Acceptance of heavy parcels (*i.e.* of parcels weighing from 11 lb. to 22 lb. each) in the services to Germany and Switzerland.

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VACANCIES FOR APPRENTICE CLERKS, R.A.F.

THE Air Ministry announces that sixty vacancies exist in the Royal Air Force for well-educated boys, between the ages of 15½ and 17, to enter as apprentice clerks. Approximately 40 of the posts will be filled by means of an open competition, which will be held by the Civil Service Commissioners in October at various centres and the remaining 20 by direct entry of boys who have obtained an approved school certificate. Successful candidates will be required to complete a period of 12 years' regular Air Force service after reaching the age of 18, in addition to the training period. At the age of 30, they may return to civil life or may be allowed to re-engage to complete time for pension.

Detailed information regarding the apprentice clerk scheme can be obtained from the Secretary, Air Ministry, Kingsway, London, W.C.2.

Boys entered under this scheme undergo a two years' course of training in clerical duties, typewriting, shorthand, book-keeping and practical office routine, during which time their general education is continued under qualified schoolmasters.

The apprentice clerks are paid 7*s.* per week for the first year and 10*s.* 6*d.* per week afterwards until they have both attained the age of 18 and have been posted for duty after passing their final examination. The subsequent commencing rates of pay, varying from 21*s.* to 31*s.* 6*d.* per week, depend upon the degree of success achieved at this examination. In addition, they receive free board and lodging.

An opportunity will be given to all apprentice clerks to volunteer for training as airman pilots, of whom a few are periodically selected for commissioned rank.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

COMMITTEE Meeting held on July 19.

Present: Brig.-General Sir Capel Holden, K.C.B., F.R.S., in the Chair; Air Vice-Marshal Sir W. S. Brancker, K.C.B.; Mr. Ernest C. Bucknall; Mr. E. J. B. How; Wing-Commander T. O'B. Hubbard, M.C., A.F.C.; Lieut.-Colonel Sir Francis K. McClean, A.F.C.; Lieut.-Colonel M. O'Gorman, C.B.; Mr. F. Handley Page, C.B.E.; Major S. V. Sippe, D.S.O.; H. E. Perrin, Secretary; B. Stevenson, Assistant Secretary.

Lieut.-Col. Sir Francis K. McClean, A.F.C.—Sir Capel Holden moved a vote of congratulation to Sir Francis McClean on the honour of Knighthood which had been conferred upon him by his Majesty the King, which was passed with acclamation. Sir Francis McClean thanked the Committee.

Election of Chairman.—Lord Thomson was duly elected Chairman of the Club for the current year.

Election of Members.—The following new Members were elected:—A. B. Hughes, Flying Officer H. B. Barrett, Woolf Barnato, H. H. Storrs, H. Thompson, Flying Officer F. W. M. Downer, R. A. Mitchell, Tomotsu Aiba, R. J. A. White, Wilfrid Caldwell, J. C. C. Taylor.

Petroleum Distributors Committee Fund.—The Committee authorised the grant of £200 to the Midland Aero Club.

Aviators' Certificates.—The following Aviators' Certificates were granted:—

8003. Frederick George Miles. June 15, 1926.
8004. John Shuldham Schreiber. June 23, 1926.
8005. George Hugh Craig. June 24, 1926.
8006. John Fishwick Leeming June 25, 1926.
8007. Gareth Wyndham Hadrian Wallcousins. July 1, 1926.
8008. Eric D'Eresby Moss. July 1, 1926.
8009. Kenneth Betts Walton. July 5, 1926.
8010. Arthur Percival Hunt. July 7, 1926.
8011. Percy Michelson. July 11, 1926.
8012. Maurice Burton. July 14, 1926.

THE RACING COMMITTEE

Held on July 20

Present.—Air Vice-Marshal Sir Sefton Brancker; Lieut.-Colonel M. O. Darby; Howard T. Wright; Lieut.-Colonel Sir Francis McClean; Major H. Hemming; Capt. C. W. Wilson; Capt. W. Dancy; Major R. H. Mayo; Lord E. Grosvenor; H. E. Perrin, Secretary.

King's Cup Air Race.—The Committee dealt with various points raised in connection with the recent King's Cup Air Race.

Aerial Derby.—It was decided not to hold the Aerial Derby this year, but to make an early announcement of the Aerial Derby for 1927.

It was further decided that for 1927 the Race should be a Scratch race.

Light Aeroplane Competition, 1926.—The list of entries received up to June 30 was submitted.

Grosvenor Challenge Cup.—It was decided that the race for the Grosvenor Challenge Cup should be over a course of 100 miles, and that the circuit should be reduced to not more than 10 miles.

It was further decided that the handicap should be on a time allowance basis on the known performances of the machines.

Bournemouth Race Meeting.—The report of the Sub-Committee (Col. Bristow and Major Hemming) on their visit to the racecourse at Bournemouth was received.

It was decided to hold the Race meeting on August 21 and 22, and the sub-committee was appointed to draw up the programme of events.

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary

THE LYMPNE LIGHT 'PLANE MEETING

September 10–18

LIST OF ENTRIES.

Entrant.	Machine.	Engine.
Blackburn Aeroplane Co.	"Bluebird"	Armstrong-Siddeley "Genet."
De Havilland Aircraft Co.	D.H. "Moth"	Armstrong-Siddeley "Genet."
Bristol Aeroplane Co.	Bristol "Brownie"	Bristol "Cherub."
R.A.E. Aero Club ..	Hawker "Cygnet"	Bristol "Cherub."
R.A.E. Aero Club ..	"Sirocco"	Bristol "Cherub."
T.O.M. Sopwith and F. Sigrist	Hawker "Cygnet II."	Bristol "Cherub."
Supermarine Aviation Works	Supermarine Light 'plane.	Bristol "Cherub."
Halton Aero Club ..	Halton Biplane	Bristol "Cherub."
A.V. Roe & Co. ..	Avro "Avian"	Armstrong-Siddeley "Genet."
A. V. Roe & Co. ..	Avro "Avis"	Blackburne "Thrush" or A.B.C. "Scorpion."
Cranwell Light 'Plane Club	C.L.A. 4	"P" Engine.
Cranwell Light 'Plane Club	C.L.A. 4	Bristol "Cherub."
H. W. Martin ..	A.N.E.C.	Blackburne "Thrush"
George G. Parnall..	"Pixie III"	Bristol "Cherub."
Seven Aeroplane Club	Monoplane	A.B.C. "Scorpion."
Seven Aeroplane Club	Biplane	A.B.C. "Scorpion."

THE list of entries for the two-seater light 'plane competition to be held under the Competition Rules of the Royal Aero Club at Lympne in September, for prizes totalling £5,000 offered by the proprietors of the *Daily Mail*, has now been issued, and is given herewith. So far, 16 machines have been entered, but as late entries are received, at a late entrance fee of £30, up till July 31, there is just a possibility that one or two more machines may be entered.

It will be observed that there is a somewhat disappointingly small number of new machines entered, quite a large proportion being the two-seaters of the 1925 Lympne competition. Generally speaking, the new types appear to have been entered by private clubs or individuals, and the aircraft industry as a whole has not come forward as might have been expected. (The meaning of the last sentence may be interpreted in two ways. We leave it to our readers which they will choose.)

The only new engine being used is the Armstrong-Siddeley "Genet," about which the only information available is that it is "any of several species of small Carnivora of the genus *Genetta*, allied to the civets, but having the scent glands less developed, and without a pouch, and with perfectly retractile claws." In addition to all these features, we believe the "Genet" is also a radial air-cooled.

As far as we are aware, the "Genet" has not yet passed its type tests, and the same applies to the A.B.C. "Scorpion," but doubtless both will do so in good time before the competition, as it is one of the stipulations that all engines used in the competition must have passed their Air Ministry tests.

The "P" engine in the C.L.A. 4 is believed to be the new radial produced at Cranwell.

AN INTERESTING TRIP WITH A "JUPITER" ENGINE

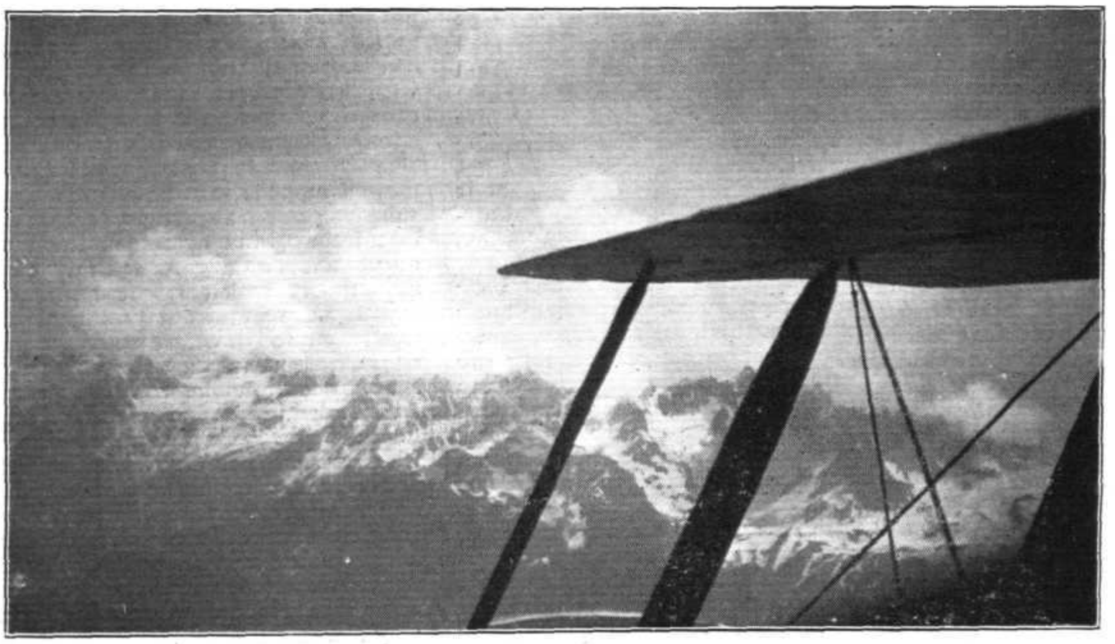
The Passenger's Story of London to Cairo in $50\frac{1}{2}$ Hours

Some few weeks back a Bristol "Bloodhound" biplane, fitted with a Series VI Bristol "Jupiter" air-cooled aero engine, carried out a remarkable endurance flight of 25,000 miles in 225 hours under official supervision, during which not a single replacement or adjustment was made to the sealed engine. With only one valve and spring replaced the engine was refitted in the machine and again sealed, and arrangements were made with Col. Minchin, the well-known Imperial Airways pilot, to attempt to make the flight from Croydon to Cairo in two days, a time in which this journey had never yet been accomplished. Delays at two of the landing points prevented the journey being completed within this time, which was exceeded by two and a half hours only. Col. Minchin was accompanied by Mr. F. Mayer, who has compiled the following interesting record of the flight.—Ed.

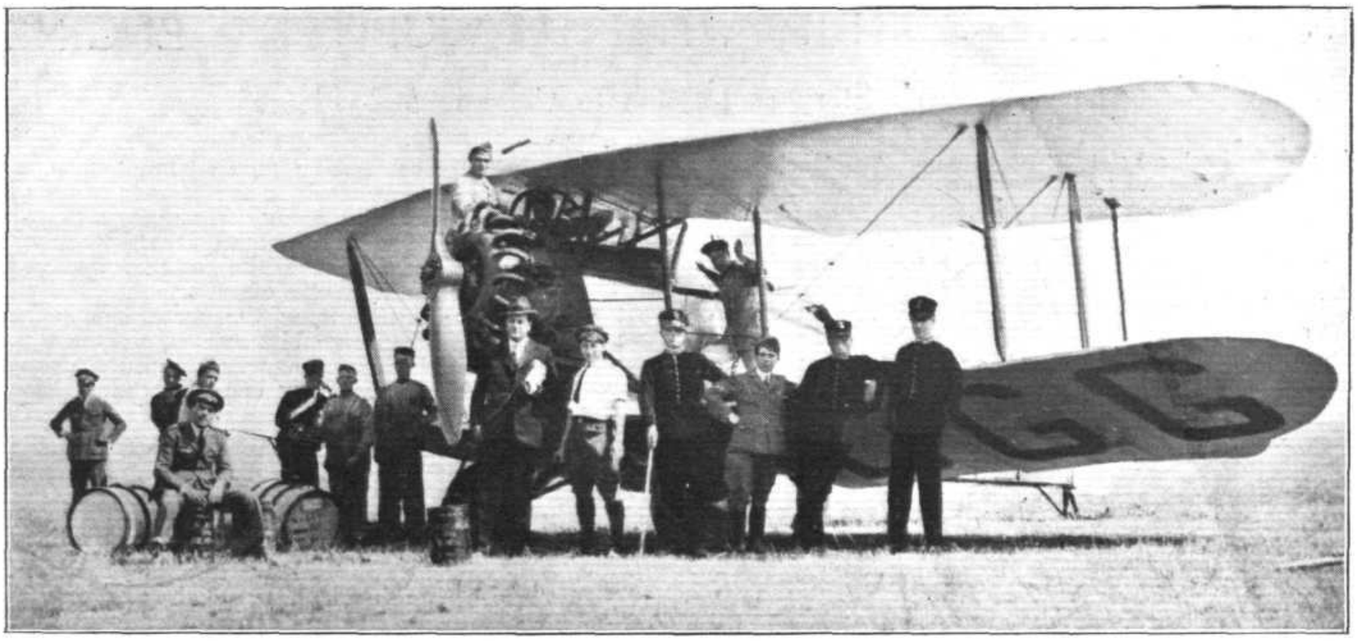
It was on the morning of June 30 that we set out from Croydon. In the darkness we made our preparations, and dawn was just breaking when we took off at 4 o'clock. Apparently it was well that we did not delay our departure, because I have since been informed that hardly had we left the aerodrome before a thick ground mist fell which would have rendered a take-off impossible. As a matter of fact, during the trip from Croydon to the coast the ground mist and the darkness of early dawn prevented our seeing anything whatever of the country over which we were flying. We made a fairly long crossing over the sea, but soon after we hit the French coast the sun came out brightly and the weather appeared to promise well for the earlier stages of our trip.

At 8 o'clock we landed upon the aerodrome at Dijon. Here the first of our many troubles started, and, considering our desire to lose as little time as possible in order to make a speedy flight, it was irritating enough. Sure enough, a wagon with 50-gallon drums of petrol and oil was in waiting; but there was no means of getting the petrol into the tanks, which were on the top wing of the aeroplane, and quite a time was lost searching for cans and funnels. At last, Col. Minchin and myself, gallantly aided by the agent of the petrol company, succeeded in getting about 100 galls. of petrol into the tanks. In the meantime, having had some previous experience of customs delays, we had telephoned to the customs officer at Dijon, about five miles distant. He informed us that he would start immediately for the aerodrome. The minutes steadily passed, and when at the end of an hour and a half he had still not appeared our

London-Cairo with a "Jupiter": The Bristol "Bloodhound," Col. Minchin, and Mr. Mayer at Croydon before the flight commenced.



London-Cairo with a "Jupiter": A view in the Alps, near the Mount Cenis Pass.



LONDON-CAIRO WITH A "JUPITER": Filling up with "Shell" at Pisa.

patience began to get a little frayed. However, when he eventually arrived, having made the journey on a bicycle, we were compelled to refrain from complaining, for the officer was a cripple who had lost a leg in the war. Once upon the spot, he afforded us the quickest possible clearance, and we were soon off upon the second section of our journey. When we left Croydon the temperature was 8° C.; at Dijon already the shade temperature on the ground had mounted to 26° C.

The first half-hour on this section of our journey was over moderately good country. However, this soon changed to hills and to some very ugly-looking mountain ranges, so that it was well for one's peace of mind that we had absolute faith in our engine. As we approached this mountainous country we had been gradually climbing until we were flying at a height of 10,000 ft., and at this altitude we were able to fly along the valleys beneath the towering Alpine peaks. During our passage of the Alps it was amazing the way the weather alternated, for local storms of great violence extending over comparatively small areas were frequently met with. For instance, two of the valleys which we traversed were almost completely impassable owing to violent storm, and the severe bumps which we experienced were more than unpleasant. At the same time, the passage from these storm areas into better weather conditions was extremely rapid. One moment one would be thrown about by air bumps, and a minute afterwards we would be dashing along quite pleasantly through comparatively still air.

For a considerable period of the time of our journey through the Alps the scenery was magnificent. Flying at about 12,000 ft., on either side there towered up snowclad mountain peaks and wherever one looked in any direction impressive chains of rugged mountains stretched away into the distance, white-tipped and gradually merging from white to grey and grey to black as the altitudes decreased. The scene was grand and impressive, but still one could not get away from the fixed idea at the back of one's brain that it was only a knowledge of the reliability of our engine and aircraft which rendered an artistic appreciation of the panorama in any way possible.

We had started before dawn, so that we had had very little in the way of a night's rest before departure. Flying along at this high altitude for some hours had a very drowsy effect, both upon Col. Minchin and myself. Seated in my own cockpit, I found it extremely difficult to overcome my desire to sleep, and the series of yawns to which I had been obliged to give way had actually caused my jaws to ache. We had just flown between two ranges of mountains in somewhat calmer weather to a point where the mountains on our port side seemed to end in a wide gap. As we were approaching this gap our machine went into a left-hand diving turn, swinging round the end of the range. The manœuvre surprised me considerably, as we were turning off our compass course for which I could see no reason. As the engine had not been throttled back during this manœuvre, I rapidly oncluded that Col. Minchin was suffering from my own complaint and had fallen asleep. I gave him a push in the back with my foot (Col. Minchin afterwards described it as a kick) to remind him that we were still making for Cairo. Like the good pilot that he is, Col. Minchin first studied his compass, and then turning to me, with his invariable smile, inquired how long we had been off our course and immediately set off again in the proper direction.

After traversing the Mt. Cenis Pass and Modane, which is the official air corridor to Switzerland, the mountains decreased in height and gradually the majestic grandeur of the towering Alpine heights merged into the more sober-looking hills of Northern Italy. One could not help being strongly impressed by the unsuitability of this part of Europe for flying. With the uncertain and constantly-varying weather conditions in this mountainous region and the necessity for landing possibilities, it would almost seem that any sort of forced landing would be an impossibility. In spite of our faith in our engine, it was with almost a feeling of relief that we sighted the sea near Genoa, and flying down the coast we were not long in arriving over Pisa. The town is situated on what I believe is just about the first piece of country we had traversed during the preceding 3½ hours on which a forced landing might be made with any degree of safety. Along the whole of the coast steep hills run sheer down into the sea, and any occasional stretch of level beach appeared to be built upon to form one of the many pleasant seaside resorts along the Gulf of Genoa.

It was about 2 o'clock when we landed at Pisa and straight away we were given an impression of the good-hearted hospitality and comradeship which we were to experience at this centre. Awaiting our arrival was the Commandant of the Italian Air Force Squadron stationed at Pisa, together with his officers and the representative of the Shell Petrol Company. Everything which could have been arranged in advance for our service and personal comfort was arranged. The Commandant placed the fullest possible assistance of himself and his staff at our disposal. The mechanics of the squadron at once started to fill up our petrol tanks under our instructions, and examined the whole of our aeroplane for any possible damage which might have been done or for any adjustment which might be required. Col. Minchin and myself were immediately taken off in a car to Pisa for a wash and food, whilst the Customs formalities were being negotiated. After a speedy lunch, we were driven around Pisa by automobile for half-an-hour and were shown the leaning tower and other interesting features. In fact, the kindness which we received was almost embarrassing. When we arrived back, the Customs clearance had been effected and considerable interest was being taken in our machine and engine. This was particularly so when the reason for the seals upon the engine was explained, and when the officials heard of the service record of this particular engine, they were enormously impressed by this example of British aero engine reliability. About 4 o'clock we proceeded on our way towards Brindisi.

(To be continued.)

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

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CONTENTS

OUR CONTRIBUTORS

Dr. Leslie Aitchison, whose series of articles on Duralumin is gradually assuming the size and status of a text-book on the subject, and a very valuable one at that, continues in the present issue with a contribution dealing with the important subject of the treatment of Duralumin in the form of forgings, drop forgings and stampings, and points out that, as Duralumin has a strength, at the forging temperature, of 3 tons per square inch, as compared with a strength of 1½ tons for mild steel at *its* forging temperature, and 2 tons for nickel-chromium steel, it is essential to have an adequate supply of power for the purpose of forging the metal. Dr. Aitchison also refers to such subjects as the importance of avoiding sharp corners in Duralumin drop forgings, the necessity for sharp clipping tools in clipping Duralumin stampings, and problems connected with rate of cooling in large articles.

Mr. Rex K. Pierson, who has for a number of years been chief designer and engineer to the Vickers aircraft works at Weybridge, and among whose many types of machines is the famous Vickers "Vimy," on which the late Sir John Alcock and Sir Arthur Whitten Brown crossed the Atlantic in 1919, contributes, for the first time, an article to the present issue of THE AIRCRAFT ENGINEER. Mr. Pierson is not among those who are in the habit of getting on their "hind legs" to take part in technical discussions and the like, nor could he be described exactly as a prolific writer on matters aeronautical. It is, therefore, all the more gratifying to us that he has consented to write an article for this technical section of FLIGHT, and the subject which he has chosen, that of "Airscrew Tip Speeds," is one which has not in the past been given much attention.

Mr. Pierson arrives at the conclusion that most modern aero engines give too high tip speeds to be suitable for slow machines, and pleads for a reconsideration of gear ratios, or the provision of alternative ones for commercial aircraft.

Mr. J. D. North, whose series of articles on aircraft performance we have good cause to appreciate, has chosen for his subject this month "The Influence of Size on Performance," and comes to the conclusion that the gross structure weight consists of some parts which vary as $W^{\frac{3}{2}}$, some which vary directly as the weight, some which vary as the linear scale, and some which are constant.

DURALUMIN.

By LESLIE AITCHISON, D.Met., B.Sc., F.I.C., M.I.A.E.

(*Continued from p. 64.*)

Duralumin, being an alloy suited to either hot or cold working, can be produced in just as many forms as are possible with steel or brass or similar typical hot or cold-working materials. The limitations that are imposed upon the forms in which Duralumin can be supplied come about from the limiting capacity of the existing plant and machinery, and are not imposed by the inherent properties of the metal. As a result of this it is possible to obtain Duralumin in the form of forgings in a great variety of sizes, as drop forgings, as bars hammered or extruded, as tubes, wire, sheet, or strip. In addition, the material is capable of being extruded in a manner analogous to that possible for brass and copper, and, therefore, it can be obtained in the form of a variety of sections. In this respect Duralumin has a distinct advantage over steel.

Dealing first of all with the hot working of Duralumin. For this purpose the metal should be obtained from the manufacturers in the form of bars or roughly forged blanks. For comparatively small bars the metal would be supplied in the extruded form, but the larger sizes of the material would probably be supplied as forged. As the metal is subsequently to be worked hot, it should not be obtained in the heat-treated condition, but in the "as extruded" or "as forged" state. The most satisfactory forging temperature for Duralumin is rather lower than the heat-treatment temperature, and the most useful range may be taken to be from 400° to 440° C. If the metal is raised to too high a temperature it will not retain sufficient strength to hold together during the forging or drop-forging operation. If the metal is too cold, the usual troubles resulting in the fracture of the metal or the plant will ensue. A rough-and-ready method of ascertaining the temperature of the metal is that of pressing on the surface of the material a piece of folded newspaper. When the metal has been heated to the correct temperature it will char the newspaper. At the correct heat the newspaper will be turned to a full sepia colour in the course of about five seconds. If the paper turns black quickly, the metal is too hot. This test is, obviously, a rough one, but, in view of the latitude in the forging temperature, is sufficiently sound for the purpose.

The simple charring test described above is naturally an indicator of the temperature of the surface of the metal only, and it is definitely the business of the forger or drop-forger to ensure that the Duralumin is heated uniformly throughout its mass. This is very largely a matter of experience, together

with the use of suitable and proved heating appliances. The relatively slow absorption of heat by Duralumin has already been dealt with at length in connection with the heat-treatment process. Naturally, the same limitations have to be borne in mind in connection with the heating of the metal for forging and stamping. There is no doubt that a good deal of the trouble that has been experienced by beginners in the art of forging Duralumin must be attributed to the inadequate time allowed for soaking the material and allowing it to attain the true forging heat throughout the mass of the piece that is being worked.

In the preparation of Duralumin for forging, dry heating is strongly to be preferred. If the metal is heated, prior to drop forging, in a salt bath, it is practically inevitable that some quantity of salt still adheres to the metal when it is placed between the dies. The salt and the oil on the dies may interact chemically and produce an explosion. Such cases have actually occurred and considerable damage been done. It is admitted that salt-bath heating is probably the quickest method of raising Duralumin to the forging heat, but the danger attached to the operation makes it one which should not be employed. The methods of dry heating previously described are much slower but are definitely to be preferred, and it is quite safe to use any of them provided always that the requisite time is allowed. In order to give the material a full opportunity of soaking and becoming heated uniformly throughout its mass, it is, obviously, necessary to provide very ample muffle accommodation, as otherwise there is a great likelihood of the work being given insufficient time prior to stamping because of a shortage in the supply of fully heated metal to the stamps.

When Duralumin is being forged it is desirable to have an adequate supply of power. The metal wants "hitting" hard. At the forging temperature the strength of Duralumin is approximately three tons per square inch. This may be compared with a strength of one and a-half tons per square inch for mild steel at its forging temperature, and of two tons per square inch for nickel chromium steel when at its forging temperature. These figures alone indicate that the power required to forge Duralumin is necessarily of a higher order than that required for forging steel, and Duralumin responds to heavy working much better than it does to light working. When the power supply is adequate, Duralumin can be made to flow quite freely, but when forging with an inadequate supply of power is attempted the material very frequently breaks up.

When it is being worked between dies, Duralumin is found to flow in about the same way as the harder alloy steels. It is desirable, therefore, to arrange that the drop forgings shall be made with a very adequate radius in the corners. Sharp corners are undesirable in any kind of drop forging, and are particularly so in drop forgings made in Duralumin. Sweeping curves are greatly to be preferred, and the various parts should flow sweetly into each other as far as possible. On drop forgings the usual allowance for leave is about 7°.

One of the most pregnant sources of difficulty in the manufacture of Duralumin stampings is the clipping operation. Duralumin does not clip quite so cleanly or so easily as hot steel. It is essential, however, that the operation be carried out cleanly and accurately, or otherwise the stamping may be very definitely ruined by the formation of a deep and fine crack or fissure running along the clipping line of the drop forging. In order to avoid the formation of this defect, the flash on the stamping may be left a little full in width, so that any drag comes on the flash itself and not on the metal in the body of the stamping. A further and most important way of avoiding the trouble is to ensure that the clipping tools are thoroughly sharp, and that they register very accurately. If all these precautions are taken the stampings can be clipped hot with complete success.

A Duralumin stamping or forging has necessarily to be heat treated after shaping, in order that it shall develop its maximum mechanical properties. In the heat treatment operation the necessity for giving an adequate time allowance in order to produce a uniform temperature throughout the mass of the article is as essential as ever. With large stampings this question becomes one of great importance. Apart from it, there are no points connected with the heat treatment of forgings and drop forgings that require very special comment. A word or two, however, should be said respecting the mechanical properties of the drop forgings after they have been heat treated.

When the heat treatment of Duralumin was being described in an earlier article, it was made clear that the production of the high mechanical properties for which Duralumin is noted was a function of the quenching and ageing operations, and that the essential point in this heat treatment was the cooling of the material from an elevated temperature at a sufficiently high rate to ensure that the high temperature structure was retained in the metal down to atmospheric temperatures. In other words, although the successful heat treatment of Duralumin requires various things, above everything else a certain minimum speed must be attained in the quenching operation.

Now the speed of cooling of a piece of metal heated to an elevated temperature and then immersed in a cooling fluid is not at all uniform. It is not uniform in many directions, but the one direction which is of present interest is the variation in cooling speed of different parts of the mass located differently in respect of the outer surface of the metal. The metal composing the outside skin of the article naturally comes first into contact with the cooling fluid, and remains in contact with it during the whole of the quenching operation. The surface of the article, therefore, cools much more rapidly than any other part, and it is obvious in a general way that as the distance of any selected portion of the article from the surface increases, the rate of cooling of that part during quenching necessarily decreases. There may be a difference so great in a part of suitable dimensions that the outside will cool at a speed some hundreds of times greater than the rate at which the centre of the article is cooling.

Obviously under such circumstances it is only a question of dimensions for the interior of the article to cool so slowly during the quenching that its rate of cooling is less than the minimum rate required to bring about a retention of the high temperature structure in the metal. In other words, it is clear that when the mass of the part reaches a certain figure, the outer layers will cool sufficiently rapidly to retain fully the high temperature structure whilst the centre of the mass will cool so slowly that its structure will approximately be in a condition similar to that of annealed Duralumin.

After ageing, this difference in the rate of cooling shows its effects very markedly, and whilst the outside of a large part will possess the full tensile strength associated with Duralumin, the core of the part will only develop a lower strength, higher possibly than that of annealed Duralumin, but not so high as that of the fully treated metal such as is found on the outside of the article.

With Duralumin it seems to be clear that the largest cylinder which will harden uniformly throughout its mass when treated in the ordinary way is one of about three inches diameter. In such a part the material farthest removed from the cooling surface is distant about one and a half inches, and it seems to be not unreasonable to take this as a general guide in the heat treatment of Duralumin forgings and drop forgings, and to arrange that where the maximum strength of the material is to be employed the parts should not be thicker than is indicated. In many instances a great deal of assistance towards equalising the eventual mechanical strength can be rendered by rough machining the article before the final heat treatment, thus reducing the mass of the article and bringing the parts most distant from the cooling surface within the effective range of the quenching operation.

Naturally, if the Duralumin is not uniform in shape and cross-section it is possible that some portions of the article after heat treatment will be hardened to the centre, whilst other portions are only fully hardened for a portion of the thickness. This fact should be taken into account by the designer of the part so that due allowance can be made for a possible deficiency in strength in the thickest parts. It may be taken as a general guide that in aircraft forgings 25 tons maximum stress will be attained in the majority of places, but that where exceedingly thick parts exist the strength may fall to a value of about 21 tons per square inch.

It is unlikely that parts of such thickness will be employed that the strength falls below 20 tons after the final heat treatment of the article.

During the heat treatment of Duralumin certain changes of dimension occur. The heat treatment and ageing operations bring about definite structural modifications in the alloy. It is usual for alterations in the structure of a metal to produce alterations in its density. In those metals in which the effect of heat treatment are completed suddenly the change of dimensions due to variation in density is usually obvious and easy to cope with, because at the completion of the quenching operation the change of density is also completed. This change of density is, of course, used very considerably in connection with the hardening of steel tools and dies, and in the heat treatment of case-hardened steel parts. In Duralumin the structural changes that occur take place during both the quenching operation and the ageing period, and as a result they are more gradual. For this reason it is obvious that the final accurate machining of Duralumin parts to shape should not be carried out until the metal has aged completely. On the completion of ageing the density of the metal will have become stable, and no further change in dimensions is, therefore, likely to ensue.

Where the parts are of considerable dimensions, and particularly when they are also of a complicated shape, the influence of mass, as indicated above, once again comes into play. Naturally, if some portions of the article are fully hardened, whilst others are not fully hardened, the dimensional changes which occur in the metal will be different in the two portions. As a result the article as a whole is likely to warp somewhat during the ageing operation, because of the strains set up as a result of the varying dimensional changes produced in different portions of the article. Even if warping does occur, the forging is likely to be left in a state of strain. This strain may demonstrate its presence by causing a further distortion of the article when it is machined. The machining operation disturbs the equilibrium of the stresses. In all probability it removes the fully hardened and the partially hardened material to an unequal extent. Consequent upon the alteration of the equilibrium of the stresses, the strains in the different parts begin to operate and to bring about some warping or change of shape. The changes of dimensions that are referred to are necessarily of quite a small order, but in a large article they may accumulate to be sufficiently great to be noticeable, and to cause a certain amount of difficulty in securing accurate fitting after the final machining of the article. It is very desirable, therefore, that in all cases complete ageing shall be allowed so that as far as possible the material has reached its stable condition before any of it is removed in the machine shop.

(To be continued.)

AIRSCREW TIP SPEEDS

By R. K. PIERSON

The effect of the tip speed of an airscrew upon its efficiency has been given little serious consideration until within the last few months. Owing to the tendency of designers of aircraft engines to increase power by increasing the revolutions and by dispensing with gearing, owing to its various disadvantages, *i.e.*, increase in engine weight, and efficiency loss, the need for reliable full-scale tests upon airscrews with high tip speeds is becoming acute. Very little experimental work has been carried out, and the only work published appears to be R & M 884, giving the results of tests upon a model airscrew running at tip speeds up to the velocity of sound in air. Mention is made in this report of full-scale tests upon a DH.9a aeroplane, fitted with a Napier "Lion" engine with special gearing, but the results obtained are of very limited value.

From recent full-scale tests of airscrews with high tip speeds, it would appear highly desirable to keep tip speeds down to 850 ft./sec., both on the score of efficiency and noise. The latter feature is most important on prolonged flights in twin-engined aircraft where the pilot sits somewhere in line with the airscrews and the noise emitted by them is a maximum in their plane of rotation.

Table Showing Relation between Airscrew Diameter, Efficiency, Tip Speed and Forward Speed for Various Engines.

Engine.	Maximum revolutions.	Gear ratio.	Maximum horse-power.	80 m.p.h.				100 m.p.h.				120 m.p.h.				140 m.p.h.			
				Diameter, feet.	Tip speed, ft./sec.	η As calculated.	η Corrected for tip speed.	Diameter, feet.	Tip speed, ft./sec.	η As calculated.	η Corrected for tip speed.	Diameter, feet.	Tip speed, ft./sec.	η As calculated.	η Corrected for tip speed.	Diameter, feet.	Tip speed, ft./sec.	η As calculated.	η Corrected for tip speed.
Eagle IX	2000	0·60	395	13·3	835	72	71	12·4	780	78·5	78	11·8	740	82·5	82	11·5	723	84	84
Napier V	2200	·659	502	12·8	975	68	63	12·1	920	75	72	11·6	880	80	78	11·1	845	83	81
Napier DD	2200	1·0	502	10·4	1200	64	—	9·8	1130	70	—	9·4	1080	75	75	9·2	1060	79	69
Puma	1540	1·0	258	10·6	855	71	69	10·0	805	78	77	9·5	765	76	76	9·2	740	83·5	83
Nimbus	1600	1·0	335	11·0	925	70	67	10·4	873	76	74	10·0	840	77	76	9·6	807	83	82
Jupiter IV	1750	1·0	436	11·2	1030	67	60	10·6	970	74	69	10·2	935	78·5	75	9·75	895	82	79
Jupiter VI	1870	1·0	467	11·2	1100	65	—	10·6	1040	72	64	10·2	1000	77	71	9·75	955	81	76
Jaguar III	1760	1·0	382	10·8	1000	68	62	10·2	940	75	71	9·7	895	80	77	9·3	855	83	81
Jaguar IV	1870	1·0	421	10·8	1060	66	58	10·2	1000	73	67	9·7	955	78	73	9·3	910	82	79
Condor III	2100	·477	702	16·9	885	71	69	15·8	830	77	76	15·1	790	82	81	14·6	762	83·5	83
Condor	2200	·582	800	15·5	1040	66	59	14·6	976	73	68	13·9	930	79	75	13·3	890	82	79
Condor DD	2200	1·0	816	11·7	1350	60	—	11·0	1270	67	—	10·6	1220	73	—	10·2	1175	77	—

Engine.	160 m.p.h.				180 m.p.h.				200 m.p.h.				220 m.p.h.			
	Diameter, feet.	Tip speed, ft./sec.	η As calculated.	η Corrected for tip speed.	Diameter, feet.	Tip speed, ft./sec.	η As calculated.	η Corrected for tip speed.	Diameter, feet.	Tip speed, ft./sec.	η As calculated.	η Corrected for tip speed.	Diameter, feet.	Tip speed, ft./sec.	η As calculated.	η Corrected for tip speed.
Eagle IX	11·2	705	85	85	10·8	680	85	85	10·5	660	85·5	85·5	10.25	645	86	86
Napier V	10·8	820	84	83	10·5	800	85	84	10·2	775	85·5	85	9·9	750	86	86
Napier DD	8·8	1010	82	75	8·5	980	83·5	77	8·3	955	84·5	79	8·1	930	85	81
Puma	8·9	716	85	85	8·6	690	85	85	8·4	676	85·5	85·5	8·2	660	86	86
Nimbus	9·3	781	84·5	84	9·0	756	85	85	8·75	735	85·5	85	8·6	724	86	86
Jupiter IV	9·4	860	84	82	9·2	842	85	83	8·9	815	85·5	84	8·7	800	86	85
Jupiter VI	9·4	920	83	79	9·2	900	84	81	8·9	872	85	82·5	8·7	854	86	84
Jaguar III	9·1	840	84	82	8·8	810	85	84	8·6	790	85·5	85	8·4	775	86	85
Jaguar IV	9·1	895	83	80	8·8	860	84·5	82	8·6	840	85	83	8·4	825	85·5	84
Condor III	14·1	740	85	85	13·7	720	85·5	85	13.25	695	86	86	13·0	680	86	86
Condor	12·9	863	83	81	12·5	836	84·5	83	12.20	815	85	84	11·9	796	86	85
Condor DD	9·8	1130	80	—	9·5	1090	82	—	9·3	1070	83·5	73	9·1	1050	84	74

The accompanying curves present the results obtained in a number of tests carried out on airscrews and aircraft of various types. The method of test was similar to that employed in R & M 704, *i.e.*, the time taken to climb 1,000 ft. at various airspeeds with engine full out is measured with aneroid and stop watch, engine revolutions and air temperature being measured at the same time. The torque is deduced from a knowledge of the variation of horse-power with height, the power of the engine as given on the test bed and the revolutions observed in flight.

The thrust is given by the formula

$$T = k_D / k_L \, W \cos\theta + (A + B\, R/R_o)\, V_i^2$$

Where A is constant and B can be taken as constant over the small range of airscrew diameters used, $\frac{k_D}{k_L}$ is constant for constant W and V_i, θ is obtained from the test, being $\frac{\text{rate of climb}}{\text{forward speed}}$, and R/R_o is known when the geometrical properties of the airscrew are known. We can therefore compare the efficiencies of various airscrews when tested on the same machine.

Apart from inaccuracies of observation, the only other sources of error are instrument errors, instrument position errors and vertical air currents. The instrument and position errors were known for all the machines tested, and the tests were carried out early in the morning when the vertical air currents are small.

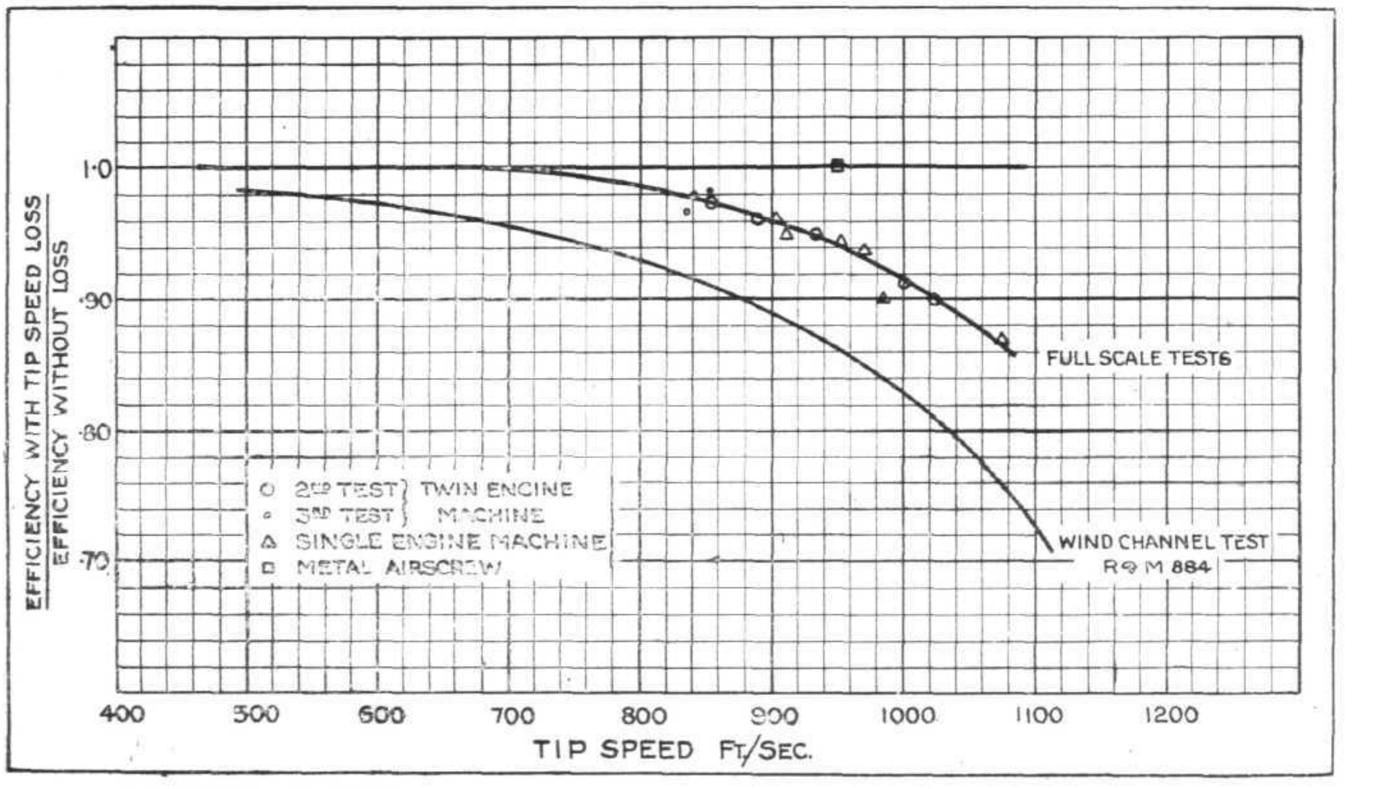
The first series of tests was carried out upon a twin-engined machine, using first a small diameter timber airscrew with tip speeds ranging from 750–800 ft./sec. On the assumption that the tip speed loss would be negligible, this airscrew was used to determine the constants A and B, and so formed the basis of comparison for the other airscrews. Another test was then carried out using an airscrew of larger diameter and running at tip speeds of 860 to 1020 ft./sec. It was immediately evident from the poorer performance obtained with these airscrews that the loss in efficiency due to the higher tip speed outweighed the gain due to the lower slipstream velocity. On analysis it was found that the efficiency fell very rapidly above tip speeds of 850 ft./sec. and that at 1,020 ft./sec. the attained efficiency was only 90 per cent. of the calculated efficiency. Above tip speeds of 900 ft./sec. the noise became very great and the aircraft could only be flown for a few minutes with the airscrews running at 1,020 ft./sec., owing to the noise causing severe head and ear pains. Endeavours were made to improve matters by making the leading edges and camber of the sections on the outer third of the blade as fine as practicable, but this modification made no measurable difference in the performance and only a small decrease in noise. A third airscrew was then tried, having a maximum tip speed of 910 ft./sec. The special feature of this airscrew was that the blade width decreased very rapidly on the outer third of the radius.

The results given by this airscrew confirmed the conclusion drawn from the preceding tests.

The second series of tests was carried out on a single-engined machine using a timber airscrew, of which the maximum tip speed was 960 ft./sec. On analysis it was found that the efficiency was only 93 per cent. of the calculated efficiency at the highest tip speed. The airscrew was then reduced in diameter, and the chord of section at tip reduced to increase the revolutions by 290 r.p.m. over those in the previous test. This increased the tip speed to 1,075 ft./sec. and the extra revolutions per minute did not improve the performance, thus showing that the extra power was being absorbed, partly by the increased drag, due to increased slipstream and partly due to tip speed loss; on analysis it was found that the attained efficiency had fallen to only 87 per cent. of the calculated efficiency. The noise emitted by this airscrew was very great and, although it caused no discomfort to the pilot, the airscrew could be heard at great distances. It should be mentioned that these tests were not so accurate as those carried out on the twin-engined machine, but nevertheless provide additional evidence that the loss due to high tip speed cannot be ignored.

The third investigation was carried out on a single-engined machine, using a Duralumin airscrew with thin solid blades; from the few tests so far carried out it appears to be possible to use tip speeds of 950 ft./sec. (the highest attainable with this airscrew) without losing any efficiency or creating any undue noise.

It is interesting to note that in the Schneider Cup Races the Americans have consistently reduced the tip speeds of their airscrews and that the winning machine last year had the lowest airscrew tip speed of any.



AIRSCREW TIP SPEEDS: Curves showing decrease of efficiency with increase of tip speed

Bearing the foregoing in mind, it is interesting to see how few modern engines are suitable for weight-carrying machines.

Assuming that the maximum speed of weight-carriers nowadays should be in the neighbourhood of 100 m.p.h., it will be seen from the accompanying table that by using the most efficient two-bladed airscrews, there are only three engines which satisfy the condition that the tip speed should not exceed 850 ft./sec. It should be mentioned that the tip speeds of some of the others could be reduced by using four-bladers or two-bladers of small diameter and large blade widths, but only calculation on the particular machine under consideration will show whether the gain in efficiency would offset the loss due to increased slipstream and insufficient airscrew diameter.

The conclusion to be drawn from the chart is that most of the modern aero engines are only suitable for high-speed aircraft, and do not enable the best performance to be obtained on slower aircraft, such as commercial machines, and that a reconsideration of the gear ratios used or the provision of alternative ones to suit the requirements of aircraft designers is highly desirable.

AIRCRAFT PERFORMANCE.

The Influence of Size on Structure Weight.

By J. D. NORTH, F.R.Ae.S.

(*Continued from p.* 60.)

The question of the structural economics of aeroplanes has always been a vexed one. Direct analytical attack is possible only in a very crude form, and a statistical presentation is vitiated by the paucity of evidence and by the fact that what evidence there is is not sufficiently detailed to permit of satisfactory correlation. It is nevertheless of first-class importance in the determination of performance, which, for practical purposes, must always be referred to the paying or military load and not to the gross weight as is done for purposes of aerodynamical analysis. As a very rough starting point, aerodynamic performance may be considered in terms of pounds per horse-power, and this in its turn may roughly be divided up into power plant, structure, and military or paying load. The difficulty of making clear cut divisions is obvious, and has actually been enhanced by the fact that usually three separate persons or organisations are responsible for the weight involved. The engine designer, the aeroplane designer, and the purchaser where he specifies his military or commercial requirements. For a fair proportion of the aeroplane weight the responsibility is joint, insomuch as the aeroplane designer actually designs parts the necessity for which is imposed on him by the requirements, direct or implied, of the engine designer and purchaser. The fact that there are three parties responsible for the weight of an aeroplane has had a very real effect on design and an even greater one on statistics. The power plant properly includes engine, airscrew, fuel and lubricant, tanks and pipes, cooling devices, exhaust systems, engine mounting and cowling, starters, engine controls and many additional items required by individual engine design. Only a part of these are usually classed as power plant. Similarly, with military load the consequential installation weight is not generally included. This has inevitably resulted in engines and equipment being designed on the basis of *net weight* and not *gross installed weight*, with uneconomical results. The aeroplane designer has to shoulder all these extra weights under the head of structure, with the result that structure percentage, as a comprehensive term, has little or no meaning as from one aeroplane to another. In addition to these points, the structural weight of an aeroplane is affected by its size and by the load factors specified for the design. The question of size may at first be most conveniently considered on the assumption that the load factor remains constant, and, therefore, that the truly structural parts of the aeroplane are subject to loads directly proportional to the gross weight of the aeroplane. This is true for aerodynamically similar machines.

The question of the influence of size on structures and mechanisms is one of first-class importance in all branches of engineering, and its influence in nature is equally notable. The physiological aspect of size has been discussed by several writers, such as, among others, Ray Lancaster, who referred to the limitations from structural considerations of the size of land animals compared with sea animals. In a paper at the Southampton Meeting of the British Association, a writer (I believe, Professor Julian Huxley) gave a paper on the functional significance of size, wherein he referred to the problem of animals of various sizes dropping down a mine shaft, and the hydrostatic pressure in a giraffe's foot. It is not proper to discuss here the question of physiology, but many of the problems of animal structure and mechanism have features which are common to all structures and mechanism. The reasons which make the bulk of the whale 40 times as great as that of the elephant are, in many respects, similar to those which determine the size of the motor omnibus and the ocean liner. The comparative size of the pterodactyl, the largest of nature's flying creatures, with the whale, has a definite relation to the comparative sizes of aeroplanes, airships and submarines.

If we discuss two bodies of different size but which are geometrically similar, that is to say, two bodies which are in all their dimensions exactly proportionate, we have a change of scale usually defined by the ratios of the linear dimensions, that is to say, that when we refer to one body as being twice as large as another we generally mean that it is twice as long, has four times the surface and eight times the bulk, and if the density be the same, of course, eight times the mass. In the case of an aeroplane, however, conditions of aerodynamical similarity make the gross weight of the aeroplane proportional to the surface. This naturally demands a change in average density. We can show, however, that the weight of the structural members must vary as L^3. In the case of ties this is easily understood. The forces acting on the ties are proportionate to the gross weight, which is in its turn proportionate to the surface (L^2), and consequently if the stress in the material is to remain constant as it must do, on the assumption that the same materials are appropriately used in all cases, then the cross-sectional area of the tie will be proportionate to the gross weight of the aeroplane. In other words, when the tie is enlarged on the same scale as the whole aeroplane, it will still be subject to the same stress, but the member is now longer by virtue of the change of scale of its length, and the weight of the tie is the product of the cross-sectional area and its length, which weight would vary as L^3. In the case of struts the same conditions apply; provided conditions of similarity are maintained, the radius of gyration of the struts will vary as L and consequently the slenderness ratio would remain unchanged. Hence the mean average permissible stress remains unaltered, and the struts follow the same law as ties. Similar conditions can equally be shown to apply to struts with lateral loading and continuous beams. In consequence, the whole range of truly structural members, fittings, etc. (truly structural in the sense that the forces on them are proportionate to the gross weight of the aeroplane), become a steadily increasing proportion of the gross weight. It might be imagined that thin hollow members could not follow on similar lines because with reduction of scale they would become so thin as to be unstable, but the conditions for elastic instability depend on the ratio between thickness, curvature and equivalent free length; thus structural members geometrically similar will sustain the same stresses from considerations of stability. The lower limitation with regard to the dimensions of members may be affected by having to resist damage in handling, and this as a human factor may be nearly independent of size, or alternatively thickness limitation may be determined by questions of corrosion where the surface volume ratio is an important factor in the structural influence of corrosion. A further restriction on small sizes comes from the problem of manufacturing difficulties, which arise with very small absolute limits. On logical grounds, limits should be on a percentage basis, and, where dimensions become very small, reasonable limits on a percentage basis may be too small as absolute figures to be a practical manufacturing proposition. Generally speaking, however, the influence of these factors is not so large as is often imagined. The fact that the

structure of the average aeroplane departs so far from the $W^{\frac{3}{2}}$ law is due partly to reduction of load factor with increasing sizes, and partly to the higher structural standards forced upon the designer of larger aeroplanes. It is even further complicated by the fact that the generally accepted term of structure is made to include, as has already been pointed out, very many parts which are not truly structural. Many efforts have been made to examine this problem, but it is sufficient for the moment to notice two or three, *i.e.*, Reports and Memorandum No. 645, on "The Effect of a Variation in Load Factor upon the Structural Weight and Performance of an Aeroplane," by A. J. S. Pippard, M.B.E., M.Sc., and No. 676, on "An Analysis of the Component Weights of Aeroplanes," by R. McK. Wood and S. B. Gates, of the R.A.E., presented by the Director of Research, both of these published under the auspices of the Advisory Committee for Aeronautics, and also a paper by W. L. Cowley, A.R.C.Sc., published in the Journal of the Royal Aeronautical Society, March, 1926, on "Aircraft Transport Economy." Pippard, in his paper, does not deal with the question of size, but deals with the question of change of load factors on aeroplanes of two classes of size which he groups as high speed fighters and bombers. For ties, beams with axial loads and fittings, he agrees that the weight of the structural member is proportional to the load factor for an aeroplane of particular weight, following the same lines as those developed above with regard to the influence of size on weight, where it was shown that the forces and, consequently, the cross-sectional area on these members varied directly as the gross weight for a given load factor. In the case of long and short struts, however, he states that the weight varies as the square root of the load factor (*i.e.*, square root of the total load of the member), on the assumption that, solid struts being used, the slenderness ratio *must necessarily change with increase of cross-sectional area.* This argument does not, of course, hold for hollow struts and other metal construction design work, since the change of slenderness ratio due to variation of gauge is negligible, and as the radius of gyration is largely chosen from considerations of *length* it would only in exceptional cases be advisable to change this ratio with change of load factor. This is an analogous argument to that already put forward, that a slenderness ratio is independent of scale. Cowley, commenting on Pippard's paper, points out that analysis of structures indicates that in the case of the fighting machines only about 50 per cent. of the total structural weight, and in the case of bombing machines only about 60 per cent., is affected by stress considerations. Pippard having suggested that the ratio of structural total weight may be expressed in the form of

$$p = 0{\cdot}155 + 0{\cdot}0235\ \mathrm{F},$$

and for bombing machines

$$p = 0{\cdot}14 + 0{\cdot}05\ \mathrm{F}.$$

In other words, that only between 50 and 60 per cent. of the structure weight could follow the $W^{\frac{3}{2}}$ law for the change of size. The actual structure percentages from which these equations are derived are roughly $33\frac{1}{3}$ and 35 respectively for the fighters and bombers, with factors of 7 for the fighters and 4 for the bombers.

In his analysis of the classes of members into which he divides the aeroplane, Pippard includes as an item "the various members which are not determined by strength considerations, but which remain the same for any load factor, *e.g.*, fabric, packing, blocks, various brackets, etc." These in themselves are not enough to account for the very large percentage which is not dependent on stress considerations, *and it is clear that the conventional conception of structure* weight includes a considerable amount of fixed weight dependent partly on the engine and partly on the functional *requirements and equipment of the aeroplane.*

It is suggested in McKinnon Wood's and Gates's paper that allowance must be made for the influence of weight of the wings on the forces *they are called upon to sustain. It is* suggested that the forces on the wings are proportional to the difference between the gross weight of the aeroplane and the wing weight. This is not strictly true, as the loads on the ribs are not relieved by the weight of the spars and interplane struts, and the bending of the spars is not relieved by the weight of the interplane struts and bracing, which is concentrated at the points of attachment. So far as this point is concerned, however, Wood's and Gates's proposal *does* follow the ordinary stressing assumptions. A more important possible source of error is due to the fact that the inertia forces, acting through the masses of the wing, which are necessary to balance the machine out in its stressed condition *(that is to say, forces due to acceleration effects) are not* always relieving loads on a wing structure. It is possible for the geometry of the wings to be such that the resultant *force in the plane of the drag bracing is upwind under certain* conditions, and in these cases the forces in the structure due to this upward component are increased as the weight* of the wings goes up. This condition, which is usually associated with machines in which the drag bracing and lift bracing are nearly at right angles, is not very economical from a structural point of view, and in attempting to find any general expressions indicating the influence of scale on structure weight, it is probably safe to neglect it; but in examining statistics from actual aeroplanes it is important to be on one's guard against such effects. Wood and Gates assume from statistical evidence that the front and rear fuselage, undercarriage and tail skid, fin rudder and tail plane remain a constant proportion of the gross weight irrespective of size. This conclusion is arrived at on the evidence of statistics representing about a dozen aeroplanes, the weights of which range from 1,500 to 10,000 lbs. So far as the truly structural parts of the fuselage and tail unit are concerned these must, for an equally effective design with constant load factor, follow the $W^{\frac{3}{2}}$ law. A part of the structure of the fuselage is influenced by the conventional change of load factor with increase of size; but in other parts the methods of stressing do not discriminate on the size question. The case of the undercarriage is rather exceptional, since for the condition of constant shock-absorbing capacity (expressed as the capacity to absorb the kinetic energy due to a definite vertical velocity), if the load factor on the undercarriage remains constant and the shape of the load-compression diagram is unaltered, the travel on the undercarriage remains a constant. Therefore, certain parts of the undercarriage will not tend to follow the $W^{\frac{3}{2}}$ law.

There are many items in a machine, such as fabric, the weight of which is proportional to the gross weight because it is customary to use a fabric whose unit weight is independent of the stresses which it has to sustain. There are some parts—such, for example, as the elevator and rudder control wires, engine control rods, etc.—the forces on which are substantially independent of the size of the aeroplane, and in which the weight would tend to vary more nearly as the change of scale L or $\sqrt{W}$, while many other items, such as hand-wheels, seats, gun mountings, etc., may be independent of the gross weight. If we neglect the influence of the weight *of the wings on the forces imposed on them, we find that* what we call the gross structure weight of an aeroplane consists of some parts which vary as $W^{\frac{3}{2}}$ (these are the truly structural parts already described), some parts which vary directly as the weight—that is to say, as the surface—some parts which vary as the linear scale, *i.e.*, $\sqrt{W}$, and some parts which are constant. We can therefore write down a general form of expression for the weight of the structure as follows:—

$$W_s = \alpha W^{\frac{3}{2}} + \beta W + \gamma W^{\frac{1}{2}} + \delta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where α, β, γ and δ are constants depending on the design of the aeroplane. W_s = total weight of structure. W = gross weight, and for the structure as a percentage in the following form:—

$$\frac{W_s}{W} = \alpha W^{\frac{1}{2}} + \beta + \gamma W^{-\frac{1}{2}} + \delta W^{-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

It will be convenient to introduce the effect of the wing weight by modifying the first term at a later stage, but it is at once apparent from equation (2) that so far as the

* I use for simplicity the term weight here and in the other places where mass would be more correct.

percentage structure is concerned increase of size results in structural economy in some respects represented by the last two terms, and loss of structural economy in others as represented by the first term. It must be clearly understood that the form of these expressions is meant to indicate only the effect of changes of sizes of geometrically similar aeroplanes, so far as the structure is concerned with a constant load factor, and with the same crew and equipment. The assumption of constant load factor is quite justified in considering the effects of changes of weight of an aeroplane to a particular specification, for example, the effect which might be caused by a change of types of engines or increase of fuel load. In addition, as scale increases the aeroplane ultimately reaches a size where further reduction of the load factor to compensate for the increased structural difficulties is no longer permissible. It is true that reduction of structure weight with size is justifiable to some extent on the grounds that the accelerations to which larger machines are subject in the manœuvres which they are normally called upon to perform are themselves smaller, but it is a little difficult to appreciate how far this is due to the lighter demands which are made upon a weaker class of aeroplane on the grounds of its known inferiority in structural strength, or how far it is associated with the inherent incapacity of the machine to have high acceleration imposed upon it. It is similarly doubtful to what extent the reduction of load factor has not originated from the absolute necessity of modifying strength requirements to make the structure of large aeroplanes practicable. These two points strike at the very root of the load factor question, and will have to be considered separately.

(To be continued.)

TECHNICAL LITERATURE.

A.R.C. REPORTS.

THE MEASUREMENT OF TORQUE GRADING ALONG AN AIRSCREW BLADE.

By G. P. DOUGLAS, D.Sc., and L. P. COOMBES, B.Sc. Presented by the Director of Scientific Research.

R. and M. No. 992 (Ae. 203). (11 pages and 16 diagrams.) June, 1926. Price 9*d*. net.

For purposes of design it is useful to know the torque grading along an airscrew blade, and a total head method was first developed by Dr. Stanton (R. and M. Nos. 460 and 475)* to find the thrust distribution along the blade. Another paper (R. and M. No. 884)† shows how to deduce from the thrust grading how the lift coefficients of the blade sections vary with speed.

The present paper explains in detail a method of measuring with a suitable yawmeter the main angular momentum in a periodic flow which fluctuates in direction as much as $\pm 40°$. It is considered that this should cover the extreme conditions to be anticipated in the slipstream.

The yawmeter has been used to determine the torques of two airscrews, and the results check satisfactorily with the values obtained by direct measurement. The torque grading given by the yawmeter agrees reasonably with that deduced from the thrust grading.

With a suitably designed yawmeter it appears possible to obtain satisfactory measurements of the torque grading along an airscrew blade.

It is hoped to apply the method here described to show the effect of high tip speeds on the drag coefficients of airscrew blade sections.

* R. & M. 460. "On a method of estimating from observations on the slipstream of an airscrew the performance of the elements of the blades and the total thrust of the screw."—Stanton and Marshall.

R. & M. 475. "Note on the prediction of the distribution of thrust over airscrew blades."—Stanton and Marshall.

† R. & M. 884. "The effects of tip speeds on airscrew performance."—G. P. Douglas and R. McKinnon Wood.

AN EXPERIMENTAL INVESTIGATION INTO THE PROPERTIES OF CERTAIN FRAMED STRUCTURES HAVING REDUNDANT BRACING MEMBERS.—REPORT No. 4.

By Prof. A. J. SUTTON PIPPARD, M.B.E., D.Sc., and G. H. W. CLIFFORD, M.Sc.

R. and M. No. 1002 (Ae. 210). (11 pages and 2 diagrams.) January, 1926. Price 6*d*. net.

This research was undertaken to measure the forces in a form of redundant structure for which the theoretical stresses could be calculated, and it is a continuation of an investigation reported previously in R. and M. Nos. 948, 971 and 977.* In the earlier experiments the joints of the hexagonal braced tube were pin-jointed, and the measured forces agreed within the experimental accuracy with the theoretical work of the Airship Stressing Panel, for which reference should be made to R. and M. 800.† On their completion it was thought advisable to ascertain the effect of making some of the longitudinal members continuous, and the experiments described in the present paper relate to this type of structure under the action of uniform shearing forces and when subjected to a torque.

In the case of the uniform shearing force, the departures from the pin-joint value of the stresses were found to be so small that no serious modification in the stress distribution is anticipated; when subjected to torque there was a greater variation from the pin-jointed case; but this was sufficiently small to fall within the limits of design accuracy.

* "An experimental investigation into the properties of certain framed structures having redundant bracing members."

† Report of the Airship Stressing Panel.

THE VARIATION OF THE PERFORMANCE OF AN AEROPLANE WITH WING LOADING.

By W. S. FARREN, M.B.E.

R. and M. No. 994 (Ae. 205). (22 pages and 12 diagrams.) December, 1925. Price 1*s*. 6*d*. net.

The present Airworthiness Regulations impose restrictions on civil aircraft with a view to reducing the risk of accidents due to such causes as failure of structure or fire in the air. It has been suggested that other risks might be reduced if further regulations were imposed defining the maximum allowable stalling speed and the minimum allowable angle of climb. Such restriction would directly affect the proportion of the total weight of an aeroplane which is available for useful load. It is necessary, therefore, to ascertain what is the price (in terms of useful load and other characteristics) which must be paid for any advantages which might be secured.

The object of this paper is to provide quantitative technical information which may assist in deciding whether it is practicable to specify a minimum performance for civil aircraft.

No attempt is made to discuss any but the technical aspects of the problem.

The paper investigates the changes which occur in the performance, load-carrying capacity, and other characteristics of an aeroplane when its wing-loading, and therefore its stalling-speed, are varied. It is assumed that the aeroplane has to conform to certain requirements. It is to make use of a given engine, to "operate" at a given air speed, and to require a fixed power at that speed. It is to carry enough fuel for a fixed duration of flight. The same general structural and aerodynamic proportions are to be preserved as the wing loading is varied.

These are, broadly, the conditions of a given commercial air service, as they react on the designer.

The results are shown graphically in Fig. 12, for a range of loading from 8 to 14 lbs./sq. ft., the various characteristics being expressed as percentages of their values for a loading of 14 lbs./sq. ft. Three different "operating" speeds have been taken (90, 100, and 110 m.p.h.), as it appears that the character of the final results depends largely on the operating speed.

The aeroplane to which Fig. 12 refers has the following characteristics for a loading of 14 lbs./sq. ft.: weight/horse-

power = 15 lbs.; top speed, = 115 m.p.h.; useful load, 28 per cent.; structure, $32\frac{1}{2}$ per cent.; power plant, fuel and crew, $39\frac{1}{2}$ per cent. Its general proportions are otherwise similar to those of the D.H.9A.

All the calculations refer to standard ground-level density, in view of the fact that (at present, at any rate) commercial flying is done at a height of two or three thousand feet.

The general conclusion is that for an aeroplane of the type chosen (which is representative of the modern commercial machine of moderate size) there is little reason to adopt a loading higher than about 10 lbs./sq. ft. when the speed at which the service operates is 90 m.p.h. For higher operating speeds useful load must be sacrificed (20 per cent. at 100 m.p.h. and 30 per cent. at 110 m.p.h. for a reduction of loading from 14 to 10 lbs./sq. ft.). At all operating speeds there is a large gain (of the order of 50 per cent.) in the angle of climb for the same reduction in loading.

Although these conclusions apply strictly only to aeroplanes of the type chosen as a basis, there seems no reason to suppose that there would be any important difference if another type, or size, were selected for investigation. The main effect is due to the way in which the drag of the wings depends on their lift, and this (the induced drag of the Prandtl theory) depends only on the speed and loading so long as the general proportions of the aeroplane are unchanged.

Note.—Formulæ are developed which enable the direction and rate of change for several of the more important characteristics to be obtained for small variation in wing loading from any desired starting point.

ON THE CONCENTRATION OF STRESS IN THE NEIGHBOURHOOD OF A SMALL SPHERICAL FLAW; AND ON THE PROPAGATION OF FATIGUE FRACTURES IN "STATISTICALLY ISOTROPIC" MATERIALS.

By R. V. SOUTHWELL, M.A., F.R.S., and H. J. GOUGH, M.B.E., B.Sc.

R. and M. No. 1003 (M. 33). (22 pages and 12 diagrams.) January, 1921. Price 1*s*. 3*d*. net.

The presence of flaws in materials results in structural weakness, and this matter is discussed in the present paper both from the general standpoint of elasticity and on theoretical grounds. References are made to other workers on the subject, including Dr. A. A. Griffith, in his paper to the Royal Society, Vol. 221, 1920, and Prof. Jenkin's presidential address to Section G at the 1920 meeting of the British Association.

It appears not to be possible to say in advance how the planes of greatest weakness will lie in a given region of concentrated stress, nor why, when a shaft fails, the crack should develop usually in a spiral direction. Equations are developed for the stress concentration produced by a small spherical flaw in materials subjected to uniform tension, and it is found that the intensification is not dependent on the actual magnitude of the flaw. It is concluded that a fatigue fracture once started follows that surface on which the greatest principal tensile stress occurs, and the directions of special weakness must, in the author's opinion, have been established by the time the first flaw was formed.

The paper is illustrated by a number of excellent examples of fatigue failures in steel specimens.

NOTES ON "DETONATION" TEMPERATURES IN CLOSED-VESSEL EXPLOSIONS.

By R. W. FENNING, M.B.E., B.Sc., D.I.C.

Work performed at the National Physical Laboratory for the Engineering Research Board of the Department of Scientific and Industrial Research.

R. and M. No. 1005 (E. 17). (4 pages, 1 diagram.) March, 1926. Price 6*d*. net.

A large number of experiments have been carried out at the National Physical Laboratory on the occurrence of detonation in closed vessels, and the present note is supplementary to a previously published paper entitled "Closed-Vessel Explosions of Mixtures of Air and Liquid Fuel (Petrol, Hexane and Benzene) over a Wide Range of Mixture Strength, Initial Temperature and Initial Pressure" (R. and M. 979).

The discussion is continued of the effect of temperature and pressure of the unburnt residue of the charge at the start of "knock" or "detonation" on various mixtures of air-petrol, air-hexane, air-pentane and air-heptane. In closed-vessel explosions of normal mixtures of air and liquid fuel the temperature of the unburnt residue appears to be a much greater factor in the production of detonation than the pressure, the latter seeming to have little, if any, effect.

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YEAR BOOK OF THE GERMAN SCIENTIFIC AERONAUTICAL SOCIETY.

Issued as a special supplement to the "Z.F.M.," the *Berichte und Abhandlungen der W.G.L.* No. 13, of May 1926, contains the yearly report of the German *Wissenschaftliche Gesellschaft fur Luftfahrt.* The first part of this year-book is mainly devoted to the business of the society, but the second part contains a number of illustrated lectures given on the occasion of the nineteenth general meeting of the society, held at Münich. The first is a paper entitled "Some recent experiences in the construction and operation of metal aircraft," the author of which is Claudius Dornier, and which deals with such subjects as the influence of weather and water upon Duralumin aircraft parts, the proportion of spar length to spar depth if flexibility is to be avoided (for steel this is found to be less than or equal to 17 and for Duralumin the figure is 15), and the technical development of Dornier machines up to the present time. Particulars and photographs are given of a number of Dornier machines, which should be of considerable value. A. Behm delivered a lecture on "The Behm Sounder and its development as an acoustic altimeter for Aircraft," and H. Herrmann, chief designer and engineer to the Udet Aircraft Works of Munich, contributes a paper on "Topical technical problems in German Aircraft Construction." This paper deals with the details of the slotted wing machine built by the Udet firm, with the problems of undercarriage design, and with multi-engined aeroplanes, and is full of interesting information. It is well illustrated.

Dr. Ing. G. Lachmann is represented by a lecture on "Non-stalling aeroplanes," in which he goes into the subject of the slotted wing. The legal side of aviation is dealt with in a lecture by Otto Schreiber, and the insurance side by Hermann Döring.

Those interested in the Flettner rotor will discover much valuable information in the well-illustrated article on "Cinematographic pictures of the stream lines past rotary and stationary cylinders." An article by F. N. Scheubel, of Aachen, dealing with some peculiar longitudinal oscillations of the Aachen glider "Rheinland," with cinematograph films of the oscillations of a model in the wind tunnel, contributes to our knowledge of stability, and is well worth studying. The book concludes with a lecture by Bruno Eck on "Hydrodynamic methods in the turbine theory" and an account of the "Lilienthal Competition" by Georg Madelung.

Altogether, this year book is one well worth perusing. The publisher is R. Oldenbourg Verlag, Glückstrasse, 8, Munich, and the price is 14 Mark, nett.

TO CONTRIBUTORS

The attention of contributors is called to the fact that, in the case of those not known personally to the Editor, it is essential that an undertaking be given that the work is original. Contributors employed by aircraft firms should, before sending in articles for publication, submit them to the chief designer of the firm for his approval.—Ed.

THE GERMAN SEAPLANE COMPETITION

Preliminary Technical Results

CERTAIN changes have taken place in connection with the machines taking part in the German Seaplane Competition at Warnemünde. A late entry which reached Warnemünde at the eleventh hour is a new Udet, the U.13, with B.M.W. Type VI engine. This engine, incidentally, is the latest production of the Bavarian Motor Works, and is a 12-cylinder "Broad Arrow" of some 500 h.p. It was this type of engine which was fitted in the Dornier monoplane which established seven world's records recently. It is regretted that at the moment no photographs of the Udet machine are available, but we gather that it is a biplane fitted with slotted wings. Owing to the late arrival at Warnemünde of the machine, it has naturally been somewhat late in carrying out the various tests, and at the moment no official information is to hand concerning the results of its performance tests.

Of other changes, it may be mentioned that the two Dornier machines (Nos. 14 and 15 in the competition) have been scratched, no reason for this being given. They are reported to have arrived at Warnemünde and to have been placed at the disposal of the organisers of the competition, but will not take part in the competition. No. 13, the Gerbrecht three-engined machine, was not finished in time, and so is automatically eliminated.

On the evening of July 16, No. 16, the Junkers A.20, entered by the Severa Co., had a slight mishap in the speed tests. Owing to the breakage of the crankshaft casing, the machine had to make a forced landing on the sea. When the machine did not return within a reasonable time to Warnemünde, a Junkers F.13 went out to look for it, located it on the sea, and came back and reported, after which a motor cruiser went to its assistance and brought it back to Warnemünde. It was found that the A.20 had a damaged float, and this was sent by air to the Junkers works at Dessau for repairs, arriving back again in a very short time, also by air, so that the machine should soon be in flying trim again.

It may be of interest to mention that the high-speed course, which was also used in the fuel-consumption tests, was a rectangular one formed by Warnemünde–Ahrenshoop–Gjedser Rev–Brunshaupten. This course has a length of 230 kms. (143 miles), and had to be covered twice in the petrol consumption trials.

In the accompanying table we give such technical results as were available up to the time of going to press. It should be mentioned that the figures in the table are based upon official bulletins issued by the organising committee of the competition, and that, naturally, in the original the metric system was used throughout. For the benefit of English readers we have, however, thought it better to convert these figures into English units of weight and speed. In the text accompanying the official table no explanation is given of the reasons for the absence from the table of certain machines other than those already mentioned, and it is therefore assumed that these machines had not at the time of posting the official bulletins passed the various tests. Whether they will succeed in doing so later is, perhaps, doubtful, but if the information arrives after going to press with this week's issue of FLIGHT we propose to publish the late results in next week's issue.

Concerning the table itself, little need, we think, be said, as the figures are self-explanatory. It will be observed that the machine with the highest measured speed is the Heinkel H.E.5 fitted with Napier "Lion" engine. The machine with the greatest range is the Heinkel monoplane with "Jupiter" engine, the next longest range being that of No. 7, the Junkers W.33, which has a Junkers L.5 engine. The best climb recorded (this climb was measured from 3,300 to 6,600 ft.) was that of the Heinkel-Napier, which took only 4.25 minutes for the 3,300 ft., while the next best climb was scored by the Junkers W.34 with Bristol "Jupiter" engine.

It may be recollected that in our notes on the Seaplane Competition published in last week's issue, reference was made to the fact that empty weight was used as a basis for judging the quality of the construction of the machines, and in the table published herewith figures are given for ratio of useful load to empty weight. The highest value of this ratio is that of No. 3, the L.F.G. V.61, with Bristol "Jupiter," closely followed by the Heinkel H.E.5 with Gnome and Rhone "Jupiter."

In the competition machines are required to carry a service load of 880 lbs., in which figure are included the weights of pilot, engineer, equipment, etc., but not the weight of the fuel. Although the figures for useful load vary very considerably in the different machines, presumably this difference is accounted for by the greater or smaller quantity of fuel carried, and so presumably the figure for fuel consumption per mile can be taken as a direct measure of the economy of the competing machines for the service load given, although it seems possible that in some cases machines are carrying a considerably greater service load than that stipulated.

Just as we are about to go to press with this week's issue of FLIGHT a few further particulars came to hand. In the performance tests, which were passed by 10 out of the 18 machines entered, the following "figures of merit" were obtained: (the first figure is the number of the machine in the competition); 8, 0·657; 10, 0·629; 16, 0·622; 7, 0·587; 9, 0·584; 3, 0·456; 12, 0·444; 17, 0·392; 2, 0·378; 11, 0·358. Note that the machine leading in this section is the Junkers W. 34 with Bristol "Jupiter" engine.

A fatal accident has marred the competition. During the coastal flight the pilot of No. 2, the L.F.G. V. 60 biplane with B.M.W. IV engine, Herr Haase, was drowned. It appears that he had to alight on the sea for some adjustment, and was washed overboard by a wave. His passenger was picked up by a lifeboat from the island of Fehmarn, and the machine was salved.

In the coastal flight reliability trial the Heinkel H.E. 5 monoplane with Napier "Lion" engine was awarded a gold cup for the fastest time from Warnemünde to Hamburg.

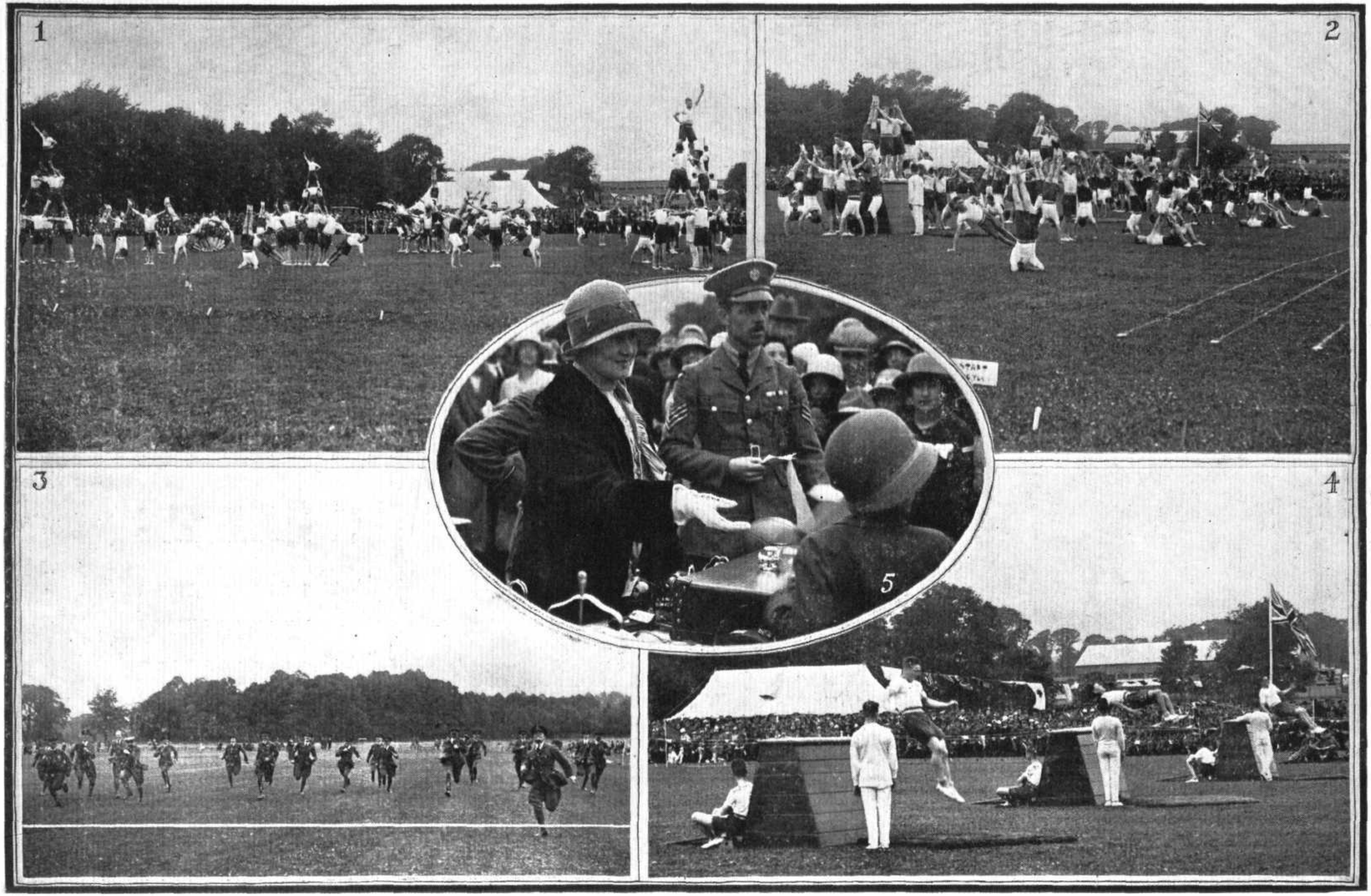
PARTICULARS OF TECHNICAL PERFORMANCE TESTS IN GERMAN SEAPLANE COMPETITION

No.	Machine and Engine.	Weight loaded (lbs.).	Weight empty (lbs.).	Useful Load (lbs.).	Useful Load. / Weight empty.	Top Speed (m.p.h.).	Take-off Speed (m.p.h.).	Climb from 1 to 2 kms. (mins.).	Fuel Consumption (lbs./mile).	Maximum Range (miles).
2	L.F.G. V60-BMW	4,400	2,970	1,430	0·484	91·3	46·0	9·05	0·843	563
3	L.F.G. V61-Jupiter	5,040	3,240	1,800	0·656	110·5	52·1	6·6	—	—
5	Rohrbach-BMW	7,150	4,460	2,690	0·602	—	—	—	—	—
7	Junkers-L.5	4,625	3,110	1,515	0·486	120·5	55·3	5·93	0·768	743
8	Junkers-Jupiter	4,725	3,135	1,590	0·476	125·5	51·5	3·6	1·193	503
9	Heinkel-Napier	5,500	3,600	1,900	0·530	126·0	65·3	4·25	1·527	586
10	Heinkel-Jupiter	5,500	3,340	2,160	0·650	121·0	54·6	5·7	1·43	890
11	Heinkel-BMW	4,580	3,110	1,470	0·475	—	—	13·1	1·395	357
12	Heinkel-BMW	4,670	3,050	1,520	0·532	—	—	7·6	1·143	578
16	Junkers-L.5	3,900	2,510	1,390	0·556	122·3	—	4·95	0·998	449
17	Heinkel-Rolls Royce	5,450	3,740	1,710	0·458	112·0	52·2	8·65	1·845	393

R.A.F. Flying Accident

THE Air Ministry regrets to announce that as the result of an aeroplane accident at Hinaidi Aerodrome, Iraq, to a Vickers Vernon of No. 45 Squadron, Hinaidi, on July 26, 1926, Flying Officer Oswald Kempson Stirling Webb, one of the two pilots of the aircraft, Sqdn.-Ldr. Eric Miller Pollard, Flight-Lieut. Reginald Carey Brinton Brading, D.F.C., No. 155685 Sergt. Edgar Kennedy, and Mr. Francis Crawfurd Inglis (Works and Buildings Department) were killed. Pilot Officer George Percy Mee, the other pilot of the aircraft, and No. 345662 A.C.1 Horace Leslie Davis were severely injured, the latter dying of his injuries shortly afterwards. No. 128624 A.C.1 James Douglas Henderson, the remaining passenger, was uninjured.

No. 354222 A.C.2 Edgar Whittle, who was working in a shed on which the machine crashed, was also killed.



["FLIGHT" *Photographs*

SPORTS AT HALTON : 1 and 2, "Set pieces" in the demonstration of physical "jerks." 3, Officers' Race. 4, Vaulting. The inset, 5, shows Mrs. Lambe, wife of Air Vice-Marshal Charles L. Lambe, C.B., C.M.G., D.S.O., Air Officer Commanding Halton, presenting the prizes.

PARENTS' DAY AT HALTON

A VERY cheery afternoon was spent at Halton on Saturday, July 24, when the parents, relations and friends of the aircraft apprentices in training there were invited to witness a display and to take part in sports of not too serious a character. It was a fine sunny afternoon, and the field laid out for the sports and decorated with flags made a gay sight; while the wooded slopes of the Chilterns rising in the background completed a very charming picture. Not all of the 3,000 apprentices in training at the school were able to have their families present, for the lads come from all over the country; but a very large number of friends turned up. Three special trains were run from Baker Street to Wendover in the morning, for which only half-rate fares were charged. The parents and friends must have felt that their boys are more lucky than most to live in such beautiful and healthy surroundings and to receive an excellent general education as well as a specialized mechanical training. As a matter of fact, a boy is really fortunate when he is selected for Halton, because only lads of the very best type are chosen. To the ordinary onlooker one of the most pleasing features of the day was the sight of these keen, clean-limbed, healthy young fellows, with intelligent, almost one could say, intellectual expressions on their faces. One would have to go far to find a finer type of young Briton. To complete things, the Halton band played during the afternoon, and it played very well. Music is said to be an education in itself, and certainly it is not neglected at this school.

The afternoon started with a parade of massed drums which created a very fine impression, and then a party of picked athletes gave a display of physical training. This was so good that it was surprising to learn that quite a number of the original team were laid up as the result of a motor omnibus accident. The substitutes in no way let down the level of performance. The vaulting displays were particularly good, and the various feats were well thought out. Many of them were very ingenious as well as clever.

We were sorry when the P.T. team formed up and marched off the ground, but the events which followed were quite charming. Little boys and little girls, some children of the staff and some relations of the apprentices, ran handicap races with great gusto, and the winners afterwards received very handsome prizes. A wheelbarrow race, with ladies as cargo in the barrows, provided comic relief. The comic element, however, was never allowed to drop, for three clowns with two donkeys kept their antics going all the afternoon. One was really a very clever gymnast.

The children of the airmen on the staff at Halton are formed into cadet corps of boys and girls on the lines of Scouts and Guides, and they wear a simple but smart uniform. The next two races were handicaps for them. The result of the girl cadets' handicap was: (1) Alma Williamson, (2) Clarice Williamson, (3) Irene Lee.

The winners among the boy cadets were: (1) Tommy Strong, (2) James Peard, (3) Arthur Farlow.

A breathless event was the inter-wing and section relay race. It was won by No. 2 Wing, the team consisting of Flight-Lieut. Elwood, Flying Officer Westaway, Sergt.-Major Walls, and Aircraft Apprentice Kennedy. The ladies then had a handicap to themselves, and the field was quite a good one. Luckiest were the ladies whose skirts were short but not tight. The handicap for warrant officers and sergeants was a much more grim affair, and it proved that grey hairs take nothing off the agility of an airman in the R.A.F. Result: (1) W.O.2 Scott, (2) W.O.2 Farlow, (3) Flight-Sergt. Perkins.

Old Haltonians back on leave from their stations, and mostly wearing mufti, then had an inter-station relay race. The O.H. cricket team won, with Old Sarum second. A skipping relay race was followed by a handicap for civilian instructors at the school. This was won by Mr. Nager, with Mr. Line second and Mr. Seers third.

The officers' handicap was run in full uniform with caps, and a certain number of swagger canes; nor did the Church Aeronautical disdain to leg it, if not with the best, at least very bravely. Result: (1) Flying Officer Simmonds, (2) Flying Officer Litton, (3) Flight-Lieut. Seward.

We returned to sheer comedy with the three-legged race, the clowns' race, and the sack race, but the handicap for fathers of apprentices was gallantly contested, and the sons of Mr. Rogers, Mr. Marshall and Mr. H. W. Farlow must be proud young men.

Perhaps the most sporting event of the day was the tug-of-war between fathers and sons. On the one side was youth, training and team work. On the other side, weight of bone and muscle. The fathers got the first pull after a hard tussle. Then the rising generation took its revenge; but in the final youth could not be served, and the patriarchs won.

A race for the bandsmen playing their instruments followed, the prizes going to those who halted nearest to a given spot when the signal went. This was won by Aircraft Apprentice Foss.

Mrs. Lambe, wife of the Air Vice-Marshal who commands Halton, then distributed the very handsome prizes. Tea was the next item, and a jolly afternoon was ended with a flying display by the officers on the staff of the school.

Thoret Again

ONCE more the famous French pilot, Lieut. Thoret, has demonstrated the capabilities of the low-power aeroplane. using the same Albert monoplane with 40 h.p. Salmson radial air-cooled engine as that on which recently he flew to Italy and back, crossing the Alps, Thoret has covered the distance between Warsaw and Paris in a non-stop flight. On the outward journey he was troubled by bad weather, and a brief log of the whole flight may be of interest. Leaving Le Bourget in the early morning of July 13, Thoret got as far as Thionville, but as he was fighting a strong head wind he decided to return. In somewhat better weather he left Le Bourget on July 15, but was forced by fog to come down at Mourmelon. The next afternoon he left Mourmelon at 2.50 p.m., and arrived in Prague at 7.30, having covered the distance of 750 km. (465 miles) at an average speed of approximately 100 m.p.h. On July 17 he flew from Prague to Warsaw, a distance of 310 miles, in four hours, or at the rate of about 78 m.p.h. The great return flight was made on July 18. Leaving Warsaw at 5.10 a.m., Thoret reached Le Bourget at 3.20 p.m., having covered 932 miles in 10 hours 10 minutes, or at an average speed of 91·5 m.p.h. For a 40 h.p. machine this is good going. During the flight from Warsaw to Paris the Salmson engine consumed 111 litres (24·5 gallons) of petrol, or an average of just over 38 miles per gallon. It would be difficult to imagine a cheaper way of covering the distance between the two cities, not to mention that it would be impossible to make the journey by any other means in so short a time.

Cobham at Rangoon

ACCORDING to the latest information available before going to press with this week's issue of FLIGHT, Mr. Alan Cobham has arrived safely at Rangoon with the de Havilland 50J, with Armstrong-Siddeley "Jaguar," on which he is flying to Australia. Leaving Bahawalpur on July 21, Cobham arrived at Delhi after having flown something like 500 miles over land in his seaplane. In taking off at Bahawalpur the machine nearly carried into the air a native who clung to the float, but ultimately he was persuaded to let go. In attempting to start from Delhi on the same day, it was discovered that pieces of cloth, stuffed into the air-intake pipes to prevent dust and insects getting in, had accidentally been left in and had got sucked into the induction pipes. By the time this trouble was discovered it was too late to continue, and so Cobham did not get away from Delhi until July 22, when he made the flight to Allahabad, some 400 miles, without incident. A start was made for Calcutta on July 23, and, flying along the Ganges in heavy rainstorms, Calcutta was reached in 6¾ hours, a distance of about 600 miles. The next day, July 24, Cobham flew from Calcutta to Akyab in fairly bad weather, and on Sunday, July 25, he reached Rangoon, after what he described as one of his worst flights through monsoon rain-storms. These became so bad when the machine was some 20 miles from Rangoon that it proved necessary to alight and make inquiries from the skipper of a small steamer as to their exact location. A strong current carried the machine into the bushes, but the steamer ultimately towed it clear, and the 50J reached Rangoon in safety, the flight having demonstrated the capabilities of the seaplane type of machine in a most convincing fashion.

The D.H. "Hercules"

IT has been decided to adopt the type name "Hercules" for the De Havilland D.H.66 three-engined commercial aeroplane, of which several are now building for Imperial Airways Cairo-Karache route.

THE YORKSHIRE AIR PAGEANT

To the Yorkshire Aeroplane Club falls the credit of arranging the first Inter-Flying Club Race Meeting, and the Committee and Members are to be congratulated on their enterprise in running the Yorkshire Air Pageant at Sherburn-in-Elmet last Saturday, July 24. The meeting would undoubtedly have been a great success had it not been marred by the breaking of a violent storm about half-way through the afternoon.

The programme of events was an ambitious one, and had attracted entries from the London, Lancashire and Newcastle clubs, from several private owners and from the Blackburn Aeroplane Company, A. V. Roe & Co., and The De Havilland Aircraft Company. Good advertising throughout Yorkshire brought large crowds to the aerodrome despite its somewhat inaccessible position. In fact, the police at one time reported queues of motor cars and charabancs up to 2 miles long awaiting admittance to the enclosures. Estimates made on the ground placed the attendance between five and eight thousand, and it is greatly to be regretted that such a crowd of potential supporters of aviation should, by the inclemency of the weather, only have seen half the events which had been arranged for their benefit, although the spectators appeared to be well pleased with the flying which they did see.

The proceedings opened just before 3 o'clock with a demonstration flight by Captain H. S. Broad on his King's Cup winning "Moth." His masterly handling of the little machine and his low loops evoked a round of enthusiastic applause. The first competitive event was a race for club pilot instructors. Sharp at 3 o'clock, six "Moths" left on the 20 miles' triangular course, with turning points at Selby and Tadcaster. Before they were out of sight, the field appeared to have strung out considerably and it looked as though someone might have an easy win. About 15 minutes later, however, three machines appeared in sight very low and very close. They skimmed over the aerodrome hedge and passed over the line in the following order: first, Captain J. D. Parkinson on the Newcastle Club "Moth" G-EBLY; second, Captain F. G. M. Sparks on the London Club "Moth," G-EBNY; and third, Captain A. M. West on the home club "Moth," G-EBNN. It appeared that after the first turning point these three had raced neck and neck, in fact, Sparks stated that "a pocket handkerchief would have covered the three of them."

As the winner came in to land, the three Lancashire "Moths" flown by Messrs. T. Neville Stack, J. J. Scholes, and J. C. Cantrill appeared in sight, flying in close formation and having apparently lost time through getting slightly off their course.

Next came an Inter-Club Relay Race. Teams consisting of three club instructors or members had to fly round a short course three times on club "Moths," landing at the aerodrome between each circuit to change pilots. Four teams—one from Yorkshire, two from London, and one from Lancashire—competed. Unfortunately two were eliminated at the end of the first circuit owing to a collision on the ground. As the machines were taxying to the starting line in order to change pilots, a mechanic caught the wing tip of the Lancashire "Moth" with Mr. Scholes in the pilot's seat and pulled it round into the London "Moth" flown by Mrs. Eliott-Lynn. Both machines were damaged, although the London one was able to fly back to Stag Lane on the following day. The race was won by the Yorkshire Club who led the second London team by half a mile.

There was a large field for the next event—the Open Handicap Race, six D.H. "Moths," three Renault-Avros and one rotary Avro competing. Owing to the large field, the "Moths" were despatched at intervals of a minute, although the three Renault-Avros left the aerodrome together. Thus the result of the race could only be found by calculation. The winner was Captain T. Neville Stack on the Lancashire Avro presented to the Club by Colonel M. Ormonde Darby; the second, the red Newcastle "Moth" flown by Captain Parkinson; and the third, Captain A. G. Lamplugh of the British Aviation Insurance Group, who flew the London club "Moth." Unfortunately, Captain Broad had to retire at Selby owing to a blocked petrol pipe. The only landing ground was a field of high corn which caused the machine to turn over on its back. Neither Captain Broad nor Mr. Will Hay, his passenger, was hurt and the machine is now being repaired.

During the handicap race the storm, which had already upset the Test Match at Manchester, reached Yorkshire; the rain became so heavy that the roads rapidly turned into rivers, and the aerodrome resembled a marsh. In a less violent interval, the Private Owners' Race was run. The two entrants, Mrs. Eliott-Lynn and Sir John Rhodes, both on their own "Moths," flew a close race and at the post Mrs. Lynn led by a few seconds. Her win can be attributed to the fact that the small wheels fitted to her machine offered less resistance than the "balloons" on her opponent's.

During the race, Mr. Bert Hinkler put up a fine show of stunting and "crazy flying" on an Avro "Gosport." An attempt was made to carry out the Bomb Dropping Competition, but immediately the first "Moth" took off the storm redoubled itself, this time with thunder and lightning, so the Committee wisely decided to abandon flying for the day.

So as not to disappoint the schoolboys who had come to see the "fireworks," the pyrotechnic Sub-Committee allowed the fort, which had been erected on the far side of the aerodrome from the enclosure, to be bombed by invisible aircraft. The explosions rivalled the thunder, and according to best traditions the embattled walls were demolished.

Lessons of the Yorkshire Pageant.

Other Aeroplane Clubs who contemplate running similar events in their own counties, should be encouraged by the support which was given to the Yorkshire Air Pageant by the public, for it seems that, at any rate in the provinces, well-run meetings can attract really large "gates," despite the fact that aerodromes may be situated at some distance from large towns.

The enterprise of the Yorkshire Club and the keenness of the individual members set an excellent example, and it was undoubtedly only due to inexperience in organising race meetings that some of the arrangements left something to be desired. There were several lessons to be learnt at Sherburn-in-Elmet, however, and the following suggestions to the organisers of future Club Meetings are put forward in no carping spirit. They are brief, but nevertheless important, if Pageants, Meetings and Displays are to be successful from every point of view.

Access to the aerodromes, both for pedestrians and cars, must be made as easy and rapid as inaccessibility of aerodromes will permit. On Saturday, at one time, there was a queue of cars nearly two miles long. This could easily have been avoided if, instead of taking money at the entrance to the ground, a dozen Boy Scouts had been allowed to board approaching cars several hundred yards from the gates in order to sell tickets. This system works admirably at the R.A.F. Display every year, and would have relieved the congestion on Saturday.

Spectators should not be separated from their motor-cars; they are ideal substitutes for grand stands, and can be parked quite as easily in an enclosure on the edge of an aerodrome behind the hangars. If necessary, there can be separate enclosures for patrons who arrive on foot, who should, if possible, be provided with chairs.

The programmes sold to the public should contain the fullest possible information. Those on sale at Sherburn gave only a brief list of events. A long list of Officers of the Club was certainly included, but nowhere in the booklet was a name of a visiting Club, the name of a pilot or the markings of competing machines. People attending race meetings like to know the names of the contestants, and to be able to recognise them, and unless their programmes tell them, it cannot be expected that their interest can be held.

Competing aeroplanes should be parked near the crowd, so that, even if they are not allowed to go right up to them they can see the pilots getting in their seats, watch the engines being started up, and generally take an interest in the machines. The parking place could be situated between two enclosures.

One point concerns the racing rules and is a most important one. All aerodrome rules, handicap allowances, starting and finishing lines, race courses, special regulations, &c., should be printed and handed to all contestants at the latest three hours before the opening of the meeting. In the event of it being necessary to alter rules on the ground, a meeting of pilots should be called at which changes can be fully explained.

Never more than two, or at the very most three machines, of the same speed should be allowed to leave an aerodrome at one drop of the flag. Machines so leaving should be separated on the starting line by at least fifty yards, and there should not be a turning point within two miles of the start. Handicap races over short courses should, where the entries are numerous, be run off in heats.

Finally, it is suggested that races should always be run so that the first man over the line is the winner. Spectators like to be able to see for themselves who wins the prizes. Races which need elaborate calculations by gentlemen with slide rules and squared paper do not provide the exciting finishes which are what the British Sportsman likes to see.

THE ROYAL AIR FORCE

London Gazette, July 20, 1926.

General Duties Branch

Lt. E. J. Howes, R.A.R.O., is granted a short service comn. as a Flying Officer, for three years on active list (June 30). The follg. are granted short service comms. as Pilot Officers on probation, for five years on active list, with effect from and with seniority of July 14:—B. H. Ashton, B. W. Barton, J. Barton, H. B. Collins, R. W. Coneybeer, B. A. J. Crummy, R. C. Edwards, H. V. Forbes, R. C. Greenhalgh, R. G. Hennessy, D.S.O., M.C., D. K. Hewison, C. E. Kay, H. C. Marett, A. O. Moore, L. K. Mundy, C. Pitt-Hardacre, M. M. Restell-Little, F. H. L. Searl, F. S. Smythe, A. J. Vaughan, W. T. Walton, A. R. Ward.

The follg. Pilot Officers on probation are confirmed in rank:—A. W. Whitta (June 15); L. G. Rumsey (June 16); C. V. Mossman (June 22); D. G. K. Walker (June 22).

Flying Off. F. Barnshaw is placed on the ret. list at his own request (July 19); Flying Off. W. N. Sherlock is transfd. to Reserve, Cl. A (July 21); Flying Off. A. A. N. D. Pentland, M.C., D.F.C., is transfd. to the Reserve, Cl. C, in this rank and is granted permission to retain rank of Flight Lt. (July 21). The short service commn. of Pilot Off. on probation W. S. Barnicott is terminated on cessation of duty (July 1).

Medical Branch

L. Freeman is granted a short service commn. as a Flying Offr. for three years on active list, with effect from and with seny. of July 1. The follg. officers of the Army Dental Corps are granted temp. commns. in ranks stated on attachment to R.A.F. (July 1). They will continue to receive emoluments from Army funds:—SQUADRON LDR. J. G. Worlsey (Maj.). FLIGHT LTS.—T. K. Place (Capt.), H. J. Proctor (Capt.), H. O. Sumerling (Capt.) The follg. officers of Army Dental Corps relinquish their temp. R.A.F. commns. on return to Army duty (July 1):—SQUADRON LDR.—D. Blair (Maj.). FLIGHT LTS.—R. M. King (Capt.), D. H. W. Williamson (Capt.), A. Williams (Capt.)

Flight Lt. W. G. Weston, M.B., relinquishes his temp. commn. on ceasing to be empld. (July 1).

Memorandum

Sec. Lt. W. J. Singleton relinquishes his hon. commn. on enlistment in the Army (June 11).

Reserve of Air Force Officers

The follg. are granted commns. in the General Duties Branch as Pilot Offrs. on probation:—CL. A.—H. A. Denny (July 20). CL. A.A.—S. Armitage, R. E. Hopper, J. F. X. McKenna, G. W. Phillips, E. T. Scott, V. V. W. Valiance (July 5); D. J. T. Haynes (July 7).

Flying Off. W. M. Miller is confirmed in rank (June 28); Pilot Off. H. W. P. Stewart is transferred from Class A to Class C (July 17); Flying Off. A. J. Packham is transferred from Class B to Class C (Jan. 19).

The follg. relinquish their commns. on completion of service:—Flight Lt. W. D. Thom, D.F.C. (May 29); Flying Off. L. P. Coombes, D.F.C. (May 29); Flying Off. E. D. Salthouse (June 19); Flying Off. R. D. Leigh-Pemberton, M.C. (June 26). Flying Off. M. V. Molony relinquishes his commn. on account of ill-health and is permitted to retain his rank (July 21).

AUXILIARY AIR FORCE

General Duties Branch

The follg. to be Pilot Offrs.:—No. 601 COUNTY OF LONDON (BOMBING) SQUADRON.—J. J. Parkes (July 13); H. N. St. V. Norman (July 20); N. H. Jones (July 20). No. 602 CITY OF GLASGOW (BOMBING) SQUADRON.—J. P. Drew (July 15).

Accountant Branch

The follg. to be Pilot Offr.:—No. 602 CITY OF GLASGOW (BOMBING) SQUADRON—H. G. Davidson (July 15).

Princess Mary's R.A.F. Nursing Service

The follg. are promoted:—

STAFF NURSES TO BE SISTERS.—Miss M. G. Wiseman (act. Sister), Miss A. M. Hardwicke (act. Sister), Mrs. G. M. Ruttledge (act. Sister), Miss E. Crozier, Miss E. L. M. Graham (act. Sister), Miss A. M. Angus, Miss M. B. Morrison, Miss P. K. Pearce (act. Sister), Miss C. C. Kirkpatrick, Miss D. E. Mallett, Miss D. V. Mansell, Miss E. J. Stuart (act. Sister), Miss E. A. Nunn (act. Sister), Miss G. Inman, A.R.R.C. (act. Sister), Miss M. E. Hards, A.R.R.C. (act. Sister), Miss M. Manders, Miss F. L. White, Miss A. F. Acheson, Miss M. H. Adamson (act. Sister), Miss M. E. Garnett, Miss E. M. Featherby, Miss C. McL. Youngson (act. Sister), Miss E. W. Hunter (act. Sister), Miss K. M. Beall (act. Sister), Miss J. K. A. Browne, Miss E. M. Buckley, Miss M. B. Charlesworth, Miss M. E. Ball, Miss E. M. Burton, Miss F. M. Morey, Miss H. W. Cargill, Miss W. E. Bailey, Miss M. E. Grieveson (July 1); Miss A. W. Marsland (July 2).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Group Captain E. D. M. Robertson, D.F.C., to R.A.F. Base, Gosport to command; 19.7.26.

Wing Commander J. T. Cull, D.S.O., to H.Q., Coastal Area, for duty as Fleet Aviation Officer on Staff of C.-in-C., Atlantic Fleet; 19.7.26.

Flight-Lieuts.: C. R. Carr, D.F.C., to H.Q., Air Defence of Great Britain, Uxbridge; 10.7.26. H. E. Searson, D.F.C., to Schl. of Photography, S. Farnborough; 5.7.26. G. C. Bladon, to No. 443 Flight, Leuchars; 31.5.26. T. Humble, to No. 4 Sqdn., S. Farnborough; 6.7.26. W. E. Reason, to No. 1 Schl. of Tech. Training (Apprentices), Halton; 6.7.26. W. F. Dickson, D.S.O., A.F.C., to No. 56 Sqdn., Biggin Hill; 19.7.26. P. H. Mackworth, D.F.C., to R.A.F. Cadet College, Cranwell; 6.7.26. E. J. L. Hope, A.F.C., to R.A.F. Base, Gosport; 6.7.26. L. E. M. Gillman, to H.Q., Air Defence of Great Britain, Uxbridge; 6.7.26.

Flight Lieutenants: F. Thomasson, D.F.C., M.M., to R.A.F. Depot, Uxbridge, on transfer to Home Estab.; 2.7.26. J. A. Hollis, to R.A.F. Depot, Uxbridge, on transfer to Home Estab.; 19.6.26. J. A. Sadler, to R.A.F. Training Base, Leuchars; 19.7.26. A. R. M. Rickards, A.F.C., to No. 24 Squadron, Kenley; 19.7.26. O. E. Carter, to Home Aircraft Depot, Henlow; 1.8.26. N. C. Saward, to No. 5 Armoured Car Co., Iraq; 15.6.26. M. M. Freehill, D.F.C., to No. 1 Squadron, Iraq; 25.6.26.

Flying Officers: A. A. Jones, to No. 4 Apprentices' Wing, Cranwell; 6.7.26. W. L. Payne, to Marine Aircraft Experimental Estabt., Felixstowe; 6.7.26. W. E. Cowan, to No. 32 Sqdn., Kenley; 21.7.26. F. R. Offord, to R.A.F. Depot, Uxbridge, on transfer to Home Estabt.; 11.6.26.

Pilot Officers: J. R. Addams, to remain at No. 43 Sqdn., Henlow, instead of to No. 2 Flying Training Schl., as previously notified; F. S. Homersham, D.C.M., M.M., and J. W. Busteed, to R.A.F. Depot, Egypt; 1.7.26. P. G. Tweedie, to No. 216 Sqdn., Egypt; 2.7.26.

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LIGHT 'PLANE CLUB DOINGS

London Aeroplane Club

THE total flying during the week was 23 hours, 25 minutes.

The following members had flying instruction:—L. G. Sykes, M. P. Susman, R. G. Edkins, Col. Farfan, A. L. A. Petty, R. C. Woodcock, D. E. Martin, E. W. Russell, Lady Bailey, E. K. Blyth, A. J. Richardson, P. A. O. Davison.

The following members flew solo:—Squad.-Leader M. E. A. Wright, N. Jones, Capt. Lamplugh, Major K. M. Beaumont, G. H. Craig, W. Hay, Mrs. Eliott-Lynn, N. J. Hulbert, E. L. O. Baddeley, Capt. W. Roche Kelly A. R. Ogston, A. Lees.

The following Associate Members had joy rides: B. D. Waugh, G. W. West, Miss Sykes.

The Club will be closed down on Friday July 30, 1926, till Monday, August 9, so as to enable the Staff to have a short holiday.

The Hampshire Aeroplane Club

THE newly formed Hampshire Aeroplane Club will commence flying activities at the Hamble Aerodrome on Saturday, August 14.

The Club is receiving delivery of two De Havilland "Moth" aeroplanes on the Saturday previous, August 7th.

The "Moths" will be due to arrive at Hamble Aerodrome soon after 6 p.m. and these little aircraft will be readily distinguishable by reason of their colour, viz.:—silver and blue.

Members and their friends wishing to be present on the occasion of their arrival will be welcome.

On Wednesday of last week, Air Vice-Marshal Sir Sefton Brancker, C.M.G., D.S.O., Director of Civil Aviation, paid a surprise visit to Hamble where he inspected the club premises.

He was received by Mr. A. V. Roe, Vice-President of the Club, and in the unavoidable absence of the chairman, by Mr. R. V. Perfect, Assistant Secretary, and Mr. R. H. Bound.

Sir Sefton Brancker expressed pleasure with the commodious premises so ideally situated and prophesied a brilliant future for the Hampshire Aeroplane Club.

Midland Aero Club Ltd.

REPORT for week ending July 24, 1926.—Very bad weather with high winds considerably restricted flying throughout the whole week, with the result that the total flying time was only four hours.

The following members had flying instructions:—

C. Fellows, L. Goodway, R. L. Jackson, H. Smith, O. L. Richards.

Mr. G. Perry flew solo.

On Thursday, Col. Shelmerdine, of the Air Ministry, visited the Aerodrome in order to pass a number of members in their vive voce examination for the "A" Licences.

The Newcastle-upon-Tyne Aero Club

REPORT for week ending July 25, 1926.—This has been, again, a week of wet weather, and the total time flown during the week was only 21 hrs. 55 mins., 12 hrs. 45 mins. on LY, and 9 hrs. 10 mins. on LX.

The following members flew under instruction, with Mr. J. D. Parkinson:—Mrs. Marcks, Miss Leathart, Col. Sir Joseph Reed, Messrs. J. D. Irving, J. Bell, M. G. Thirlwell, A. D. Bruce, F. Howard Phillips, Dr. H. L. B. Dixon, A. Bell, D. H. Sandilands, J. M. Campbell.

The following members flew solo:—Mr. C. Thompson, Mr. L. Smith and Dr. Dixon.

Mr. Baxter Ellis flew with A. Bell as passenger and Mr. N. S. Todd flew solo. Mr. P. Forsyth Heppell flew with Mr. R. N. Thompson as passenger.

The following had joy-rides:—Mr. and Miss Stonehouse and the Rev. Stonehouse, Mr. Davis, Mr. Laidler and Mr. Bedson, jun.

On Saturday, Mr. Baxter Ellis and Mr. Forsyth Heppell flew over Ponteland Rifle Range, at the request of Mr. Howard Phillips, also a member of the Club, for the purpose of carrying out Infantry contact patrol exercise, etc., with Mr. Phillips's battalion of the Northumberland Fusiliers. One of the exercises, it appears, was to instruct the Infantry regarding firing upon low-flying enemy aircraft, and it is learnt that one of the pilots concerned, at any rate, felt that it would be interesting to know whether any of the infantry had forgotten to unload their rifles after shooting at targets.

Mr. J. D. Parkinson flew in the Instructors' Race at Sherburn and also in the Open Handicap; the results of this racing are reported elsewhere.

The Yorkshire Aeroplane Club are to be congratulated upon the very thorough manner in which they arranged a very interesting programme, and it was exceedingly unfortunate that such very bad weather was experienced. Though they are used to really severe weather conditions, the Newcastle Club representatives are quite satisfied that they have never experienced anything quite as wet as that through which they had to travel from Sherburn to Leeds.

There was great jubilation at Cramlington Aerodrome when the telegram announcing that Mr. Parkinson had won the Instructors' Race was received by the members present.

CORRESPONDENCE

SPEED AND USEFUL LOAD

[2141] Mr. Stephan in your issue of July 1, moves [2137] that our difference of opinion with regard to speed and useful load is due to our looking at the question from different angles.

I dissent entirely from this view. We are both endeavouring to justify what we consider in all circumstances to be the fairest and most useful expression to signify the comparative commercial efficiency of an aircraft to an operating company.

I take my stand by my letter in your issue of April 8, 1926, and, in amplification of this, by the tables on page 181 and the explanations on page 182 of your issue of March 25

Mr. Stephan is quite wrong in thinking I want to introduce a speed term and if he will refer to your issue of June 10 he will read "*If*, however, a figure of merit for speed is desired surely the coefficient, total load carried per horse-power top speed is the proper one to use."

With regard to the comparative figures in your leader June 10, for the "Hampstead" and the D.H.66, the whole basis of my efficiency figure is that a constant range must be taken, and all fuel and oil normally carried above the amount requisite for this range must be credited to paying load. As previously stated, this is what has been done in the tables.

I would repeat what I wrote in your issue of April 8. "It will be a long while before speed will rank equally with load carried per horse-power." For commercial machines I think this is now generally accepted, which is merely another way of saying that no justification can be found for taking the direct product speed × load carried per horse-power as an indication of comparative efficiency. It is the flimsiest argument that because a minimum speed is necessary, speed must be introduced into an operational efficiency co-efficient on terms co-equal with load carried.

The last thing I desire to do is to gain my point on account of Mr. Stephan's lingual handicap, but I think he fairly sums up the Fokker co-efficient when he refers to it as "our propaganda formula."

Southampton, O. E. SIMMONDS.
July 12, 1926.

CHECKING KING'S CUP ENGINES

[2142] I read with great interest the report of the King's Cup Race, but there is a point that has struck me as very curious. I cannot find that the Royal Aero Club actually check the engines which are used in a race of this sort, particularly after the event, to see whether the winning engine has conformed with its entry. I also find that during the intervals the aeroplanes were in the controls at Hendon they could not only have their engines cleaned of carbon deposit, but, if necessary, even new parts fitted.

It seems to me vital in events of this sort that one should know everything that is done, just in the way motor-car events of a reliability character are checked. The results may easily be misleading under the present method of dealing with the regulations.

Thames Ditton. S. F. EDGE
July 21, 1926.

IMPORTS AND EXPORTS, 1925-1926

AEROPLANES, airships, balloons and parts thereof (not shown separately before 1910). For 1910 and 1911 figures see "FLIGHT" for January 25, 1912; for 1912 and 1913. see "FLIGHT" for January 17, 1914; for 1914, see "FLIGHT" for January 15, 1915; for 1915, see "FLIGHT" for January 13, 1916; for 1916, see "FLIGHT" for January 11, 1917; for 1917, see "FLIGHT" for January 24, 1918; for 1918, see "FLIGHT" for January 16, 1919; for 1919, see "FLIGHT" for January 22, 1920; for 1920, see "FLIGHT" for January 13, 1921; for 1921, see "FLIGHT" for January 19, 1922; for 1922 see "FLIGHT" for January 18, 1923; for 1923, see "FLIGHT" for January 17, 1924; for 1924, see "FLIGHT" for January 22, 1925; for 1925, see "FLIGHT" for January 21, 1926.

	Imports.		Exports.		Re-Exports.	
	1925.	1926.	1925.	1926.	1925.	1926.
	£	£	£	£	£	£
Jan. ..	3,546	494	83,728	130,049	291	—
Feb. ..	985	2,089	85,639	40,416	20	6,341
Mar. ..	—	1,001	56,881	92,840	9,355	9,758
Apl. ..	321	536	78,041	160,832	6,732	5,051
May ..	560	342	74,844	118,539	15,278	—
June ..	190	24,866	71,009	6[illegible],111	667	150
	5,602	29,328	450,142	608,787	32,343	21,300

SOCIETY OF MODEL AERONAUTICAL ENGINEERS

ON Saturday, July 10, the Society sent a team of four members to the R.A.F. station at Halton Camp to take part in the model flying display given by the Halton Model Aero Club. A very successful meeting took place, in which also a third club (namely, that of Cranwell) was represented. Weather conditions were good, and the flying was excellent, so much so in fact, that two British model records were broken. These were accomplished by W. J. Plater (of the S.M.A.E. & Cranwell Club), who raised the figures for fuselage tractor models to :—

50 secs. duration .. hand-launched
and 45⅗ ,, ,, .. rising off ground.

(It is hoped to give a description with drawings of this model in FLIGHT in due course.)

On July 17, two further records were established :—

1. Autogiro model, D. A. Pavely, 22 secs. duration—430 ft. distance.
2. Fuselage seaplane, S. C. Hersom, 10 secs. (rising off water).

The first of these resulted from the "FLIGHT" Cup competition, held on the above date, which was won by Mr. Pavely, other competitors experiencing considerable difficulty with this type of model.

The next flying meeting will be held at the Sudbury ground on Saturday, August 7, at 3 p.m., being a general record day.

B. K. JOHNSON,
(*Hon. Secretary*).

PUBLICATIONS RECEIVED

The Accessory. Vol. 12, *No.* 128. *July*, 1926. Brown Brothers, Ltd., Great Eastern Street, London, E.C. 2.

Meteorological Office: Professional Notes No. 44. *The Velocity Equivalents of the Beaufort Scale.* By G. C. Simpson, C.B.E., D.Sc., F.R.S. H.M. Stationery Office, Kingsway, London, W.C.2. Price 9*d*. net.

Research Department, Woolwich. R.D. Report. No. 63. Part I.—Description and Discussion of the Air Disturbance Round Bullets in Free Flight. 1925. H.M. Stationery Office, Kingsway, London, W.C.2. Price 4*s*. net.

Catalogues

Stewart Speedometers and Motor Accessories. The Cooper-Stewart Engineering Co., Ltd., 136-7, Long Acre, London, W.C. 2.

"*Perfect Seal*" *Piston Ring.* Henderson Brothers, 77, Windsor House, Victoria Street, Westminster, S.W. 1.

AERONAUTICAL PATENT SPECIFICATIONS

***Abbreviations*: Cyl. = cylinder; i.c. = internal combustion; m. = motor. The numbers in brackets are those under which the Specifications will be printed and abridged, etc.**

APPLIED FOR IN 1925

Published July 29, 1926.

8,509. M. L. BRAMSON. Variable-pitch propellers. (254,377.)
8,677. D. E. SHAW. Rotary engine. (254,384.)
15,747. G. G. PARNALL and H. BOLAS. Cooling-arrangements for cylinders of i.c. engines. (254,495.)

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